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Antelope Specialist Group

GNUSLETTER is the biannual newsletter of the IUCN Species Survival Commission Antelope Specialist Group (ASG). First published in 1982 by first ASG Chair Richard D. Estes, the intent of *GNUSLETTER*, then and today, is the dissemination of reports and information regarding antelopes and their conservation.

ASG Members are an important network of individuals and experts working across disciplines throughout Africa and Asia. Contributions (original articles, field notes, other material relevant to antelope biology, ecology, and conservation) are welcomed and should be sent to the editor. Today *GNUSLETTER* is published in English in electronic form and distributed widely to members and non-members, and to the IUCN SSC global conservation network. To be added to the distribution list please contact asgpo@marwell.org.uk.

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Cover photo: Peninsular pronghorn male, El Vizcaino Biosphere Reserve (© *J. Warman*)

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Instructions to Contributors

In This Issue . . .

Welcome to the July 2020 issue of *GNUSLETTER*.

This bizarre period since our last publication has been marked by the global Covid-19 pandemic. We hope and wish all our antelope colleagues the best of health as you and your families safely navigate the epidemic.

Unfortunately, wildlife and antelopes are suffering from loss of protection due to government shutdowns and public stay at home guidelines. Recent publications indicate that poaching is increasing, and loss of funding and tourism dollars will impact wildlife protection. Despite the very serious shelter in place response and travel restrictions in many countries, the Antelope Specialist Group continues our mission to conserve antelopes.

Co-Chairs Philippe Chardonnet and David Mallon were involved in several projects over the past months including a mission to save the critically endangered addax population in Tin Toumma, Niger. David Mallon, along with others, has helped lead efforts to develop the Dama Gazelle Conservation Strategy and we are currently working on a roadmap for the conservation of the slender-horned gazelle. Stay tuned!

Although the pronghorn is a taxonomically unique species and not a true antelope, the IUCN SSC includes the pronghorn in the Antelope Specialist Group's remit. This issue contains two original reports on the Sonoran pronghorn (Southwest USA) and the Peninsular pronghorn (Mexico) recovery. *GNUSLETTER* is pleased to publish the reports and feature the pronghorn antelope in this edition.

In addition, this issue includes an update on the successful Northern Rangelands Trust Ishaqbini community hirola project and reserve, and a response from Clive Spinage on the Bamingui-Bangoran NP in CAR.

Several important news items include recent efforts to rescue dama gazelles in Niger and a nice update on Arabian oryx, Arabian gazelle and sand gazelle reintroduction in Oman. Also included is a significant list of recent antelope related publications.

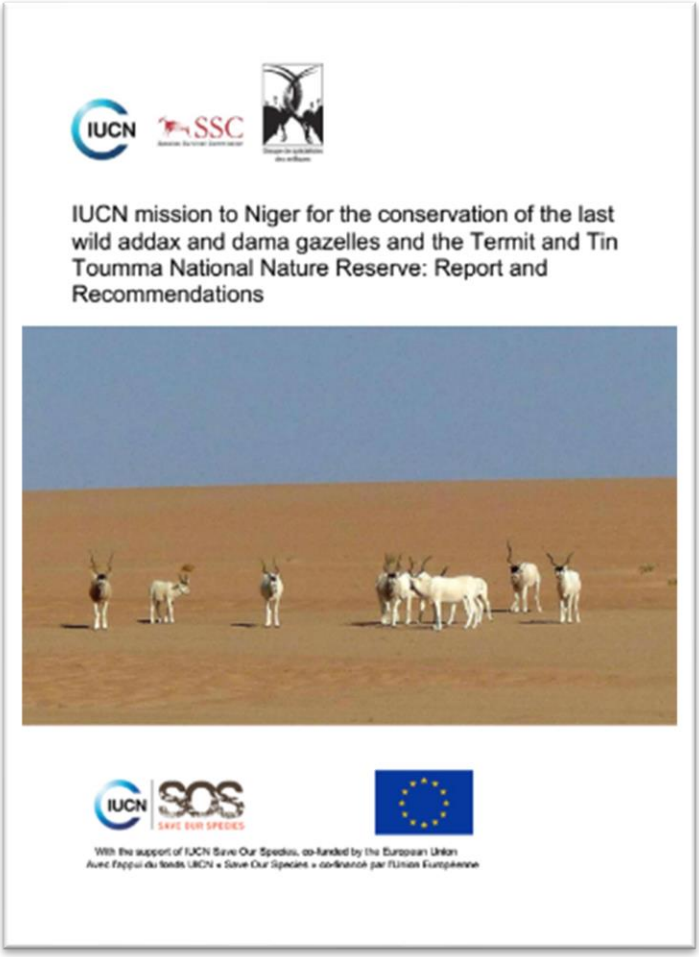
Enjoy the read and send us your feedback!

Steve Shurter, ASG *GNUSLETTER* Editor

From IUCN and ASG

IUCN Mission to Niger

Termit and Tin Toumma National Nature Reserve (TTNNR) was established in 2012, covering 97,000 km^2. The reserve is one of the most important sites for biodiversity in the entire Sahelo-Saharan region. It holds the only remaining population of addax (Critically Endangered), one of four populations of dama gazelle (also Critically Endangered) as well as relict populations of several other species of threatened birds and mammals. Management of the reserve was delegated to a French NGO "Noé" in November 2018.



The eastern part of the reserve overlaps three oil concession blocks which since 2003 have been operated mainly by the China National Petroleum Corporation (CNPC). In 2008, the government signed a Production Sharing Contract (PSC) for a period of 25 years. An article in the PSC states that "*The Contractual Area does not contain any boundaries subject to special classification or protection at national or international level. The State shall refrain from creating such boundaries in the Contractual Zones during the term of the contract*".

In June 2019, the Government of Niger issued a decree that formally amended the boundaries of the reserve, following requests from CPNC to exclude the oil blocks. Approximately 50,000km^2 of the eastern part of the reserve was declassified and replaced with areas to the west and north. The area declassified includes the oil blocks together with most of the Tin Toumma Desert and its addax population as well as about 65% of the Termit Massif and its important population of dama gazelle.

In July 2019, the Acting DG of IUCN wrote to the Minister of the Environment of Niger to express IUCN's deep concerns and offering cooperation and technical advice. An IUCN technical mission to Niamey was subsequently agreed with the Minster. The Mission took place from 18 to 27 January 2020 and consisted of Prof Awaïss Aboubacar (PACO; IUCN West and Central Africa Protected Areas Program) and Philippe Chardonnet and David Mallon (ASG Co-Chairs). It was funded by an IUCN SOS Rapid Action Grant. The Mission was warmly received in Niamey and met the Minister of Environment, Minister of the Interior, and Minister of Petroleum, the EU Ambassador, Director of the French Development Agency, numerous government officials, and key NGOs, and held two round-table discussions. It was emphasised

that addax conservation and oil extraction operations are not incompatible provided addax are protected effectively from hunting and excessive disturbance.

The mission presented a report to the Minister, including eight recommendations:

1. Reintegrate the entire Termit massif within the new boundaries of the reserve to conserve the valuable population of dama gazelle, as well as all other associated biodiversity. Establish a fixed operational base at the foot of the Termit massif to increase the effectiveness of management.

2. Ensure all stakeholders understand the very high risk of the imminent extinction of wild addax in Niger if new conservation measures are not added to those used for 20 years which have not prevented the decline of the addax.

3. Ensure full synergy and close collaboration between all stakeholders. The Eaux et Forêts (Water and Forests) administration in the Ministry of the Environment serves as the lead actor, supported by local communities, NGOs and the private sector. The private sector plays a key role in the oil concessions.

4. Implement the "Urgent programme" drawn up by Water and Forests administration as soon as possible to improve operational capacity and strengthen anti-poaching and ecological monitoring.

- In the oil blocks, conduct joint anti-poaching and monitoring patrols between Water and Forests staff, the Armed Forces, and the oil companies;
- Outside the oil blocks, in the addax zone, conduct joint anti-poaching and monitoring patrols between Water and Forests staff, the Armed Forces and community guards.

5. Implement a programme of "Immediate rescue measures" without delay, using proven effective methods to:

- Save the last individuals and avoid the extinction of the last wild population (*in situ* measures):
  - Locate the remaining individuals through ground and aerial surveys, including drones;
  - Ensure the close protection of remaining individuals through satellite collars placed on a small number of adults;
- Secure the integrity of the genetic heritage (*ex situ* measures in Niger):
  - Establish a captive nucleus of addax in Niger to preserve the genetic heritage and facilitate its reintroduction;
  - Conduct a feasibility study on the reproductive capacity of the female addax at Kelle and its active integration into the captive addax nucleus;
- Involve high authorities:
  - Involve commanders of the Armed Forces in the immediate rescue methods;
  - Implement close transboundary collaboration with the Chadian authorities.

6. Prioritize the wild population of addax in Niger before considering imports of captive animals, whether for population reinforcement or a future reintroduction.

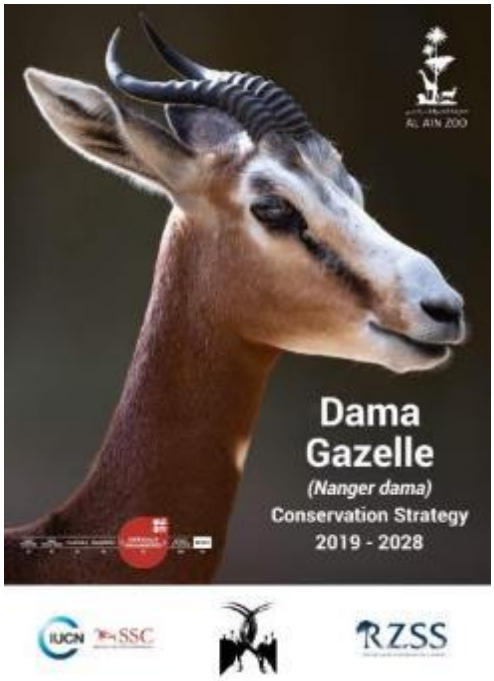
7. Participate in development of a global roadmap for addax conservation covering measures in the short-, medium- and long-term and encompassing all measures under way or planned, including:

- The immediate rescue plan in Niger;
- The recent reintroductions in Morocco and Chad;
- The managed metapopulation in Tunisia;
- The captive populations in North Africa, Middle East, Europe and North America;
- Genetic and genomic analyses.

8. Highlight the plight of the addax to the international community, notably at the next IUCN World Conservation Congress and the 15th Conference of the Parties of the Convention on Biological Diversity, in Kunming, China.

Members of the mission with H.E. M. Almoustapha Garba, Minister of the Environment, Urban Health and Sustainable Development

Dama Gazelle Conservation Strategy



The Dama Gazelle (*Nanger dama*) Conservation Strategy 2019-2028 has now been published. It was developed at a stakeholder workshop held at Al Ain Zoo, UAE, co-organized by Al Ain Zoo, Royal Zoological Society of Scotland and IUCN SSC Antelope Specialist Group (see *Gnusletter* 36#1). The strategy is available in both English and French and in hi-res and low-res versions and can be downloaded from: www.alainzoo.ae/conservation/dama-gazelle-conservation-and-research-programme

Abdullahi Hussain Ali wins a 2020 Whitley Award

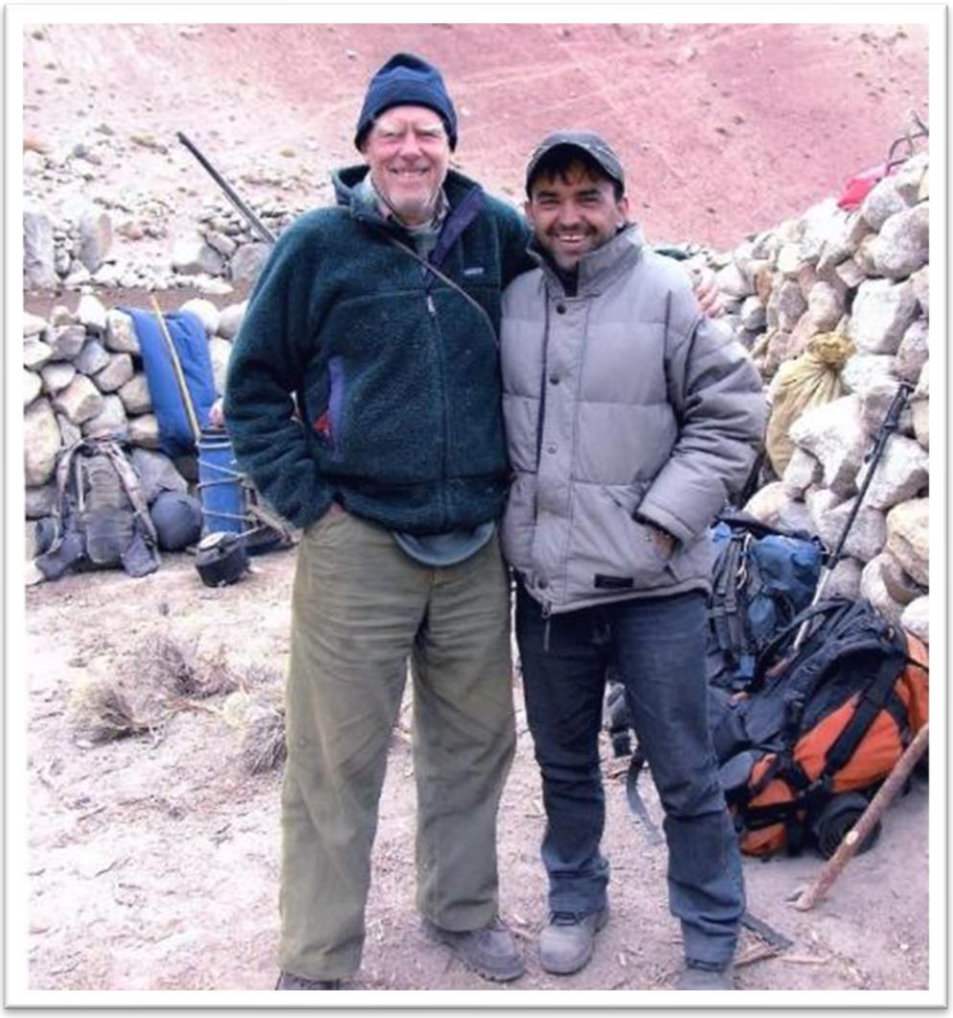
Congratulations to Ali, founder of the Hirola Conservation Programme and member of ASG on receiving this award for "*A landscape-level approach to conserve the hirola antelope*". Ali and HCP will work with pastoralist communities to introduce a planned grazing system to minimise the spread of disease between hirola and livestock and avoid overgrazing. Rangers will be trained to restore degraded habitat and use standardised field monitoring methods. They will begin to restore the 500-km^2 Arawale National Reserve and strengthen coordination between all hirola conservancies on hirola conservation efforts and build vital capacity. Regular anti-poaching patrols will protect the species and other wildlife, such as elephants and giraffes. His team will also provide education and awareness to more than over 6,000 children and adults. https://whitleyaward.org/winners/a-landscape%E2%80%90level-approach-to-conserve-the-hirola-antelope/

Impact of COVID-19 on international meetings

COVID-19 has had a major impact on international meetings:

- the Sahelo-Saharan Interest Group meeting in Almeria, Spain in early May was cancelled.
- the IUCN World Conservation Congress has been postponed until January 2021.

In Memoriam: Michael Woodford
Philippe Chardonnet



Michael Woodford died on 23 January 2020. Mike lived an outstanding life as a vet. From his 20 years in a rural practice in Dorset, UK, he acquired a genuine sense of pragmatic thinking and action. He then became a truly international veterinarian specialized in wildlife, working on an impressive series of species in an equally impressive range of countries, to name a few: Arabian oryx in Saudi Arabia and Oman, African buffalo in Uganda, screwworm in Libya, blue sheep in Pakistan, all sorts of antelopes in Kenya and Mozambique, muskox in Greenland, and many others. He initiated two major international bodies for health and diseases of wildlife, and was their first chair: the Working Group on Wildlife Diseases of the World Organisation for Animal Health (OIE) and the Veterinary Specialist Group (now the Wildlife Health Specialist Group) of the IUCN SSC. He published many reports, articles and manuals. He was quite a character, sometimes iconoclastic, always a gentleman, and very keen to welcome newcomers. He leaves his partner, two daughters and his son, John, who also worked as a vet in very many countries. He paved the way for so many veterinarians around the world and he will certainly not be forgotten in the wildlife and veterinary community.

Research and Reports

Efforts to Recover the Endangered Sonoran Pronghorn

Stephanie E. Doerries[1], Jill L. Bright[2] and John J. Hervert[2]
[1]United States Fish and Wildlife Service; [2]Arizona Game and Fish Department

Pronghorn (*Antilocapra americana*) evolved approximately 1 million years ago on the North American continent when the Great Plains more closely resembled a savanna. Their Eurasian ancestors had first reached North America about 18 million years earlier (O'Gara and Janis 2004). Evolving in the presence of the now-extinct American cheetah (Byers 1997), pronghorn are the fastest land mammal on the continent, capable of maintaining speeds of 50 to 65 km/h and exceeding speeds of 85 km/h (Kitchen 1974). Of the numerous species belonging to 18 or so genera within the family *Antilocapridae*, pronghorn are the only extant species of "American antelope."

Figure 1. A wild male Sonoran pronghorn on the Barry M. Goldwater Range (© *Stephanie Doerries, Houston Zoo*)

Specially adapted to the Sonoran Desert, the Sonoran pronghorn (*A. a. sonoriensis*) is the smallest and palest of the pronghorn subspecies (Figure 1; Goldman 1945). Sonoran pronghorn have been listed as endangered in the United States (U.S.) since 1967 (32 Federal Register 4001) and in Mexico since 1994 (NOM-059-ECOL-1994). Historically, the subspecies ranged over 142,450 km^2 in southwest Arizona and southeast California, U.S., and northwest Sonora, Mexico (USFWS 2016). Sonoran pronghorn are currently restricted to less than 12% of their historic habitat, surviving on 17,224 km^2 as five geographically isolated populations, three in southwest Arizona and two in northwest Sonora (Figure 2; USFWS 2016). In the U.S., the essential, endangered population, called the Cabeza Management Unit, ranges on 7,122 km^2 administered by the U.S. Department of Defense and Department of the Interior, including the Barry M. Goldwater Range (BMGR), Cabeza Prieta National Wildlife Refuge (CPNWR),

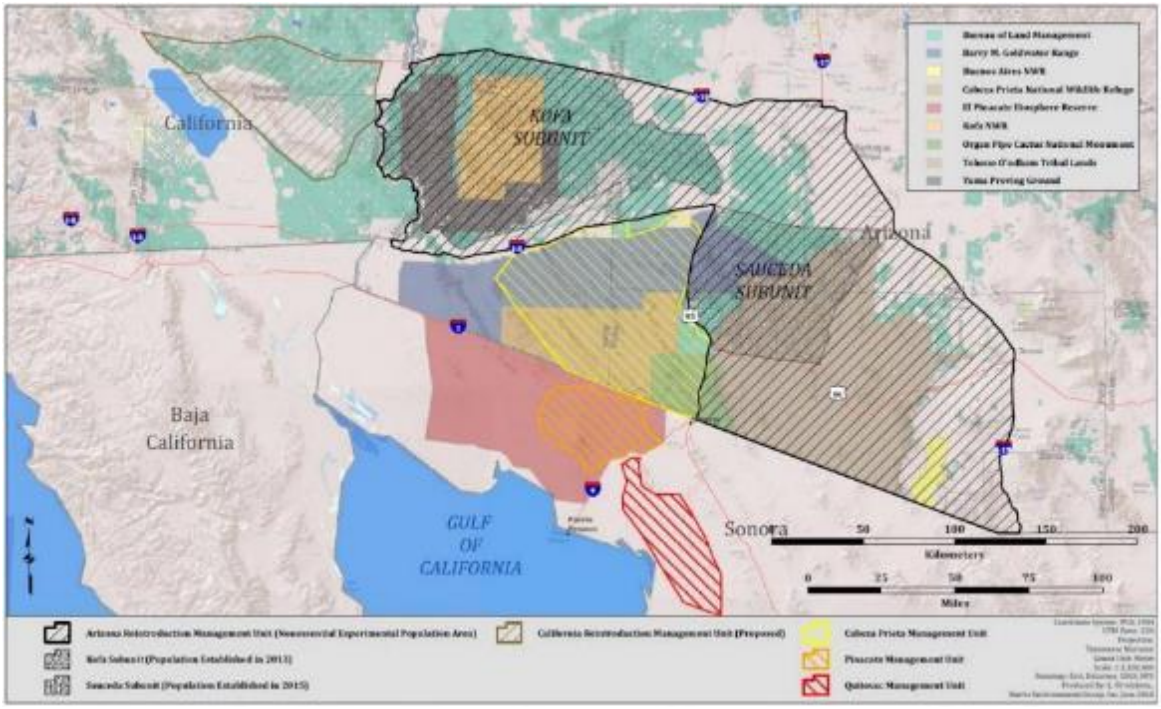


Figure 2. Sonoran pronghorn management units and subunits in the United States and Mexico (© *A. Cottulenc, Agrupacion Sierra Madre*)

Organ Pipe Cactus National Monument, and Bureau of Land Management (BLM) lands (USFWS 2010). Through reintroductions to 6,045 km^2 of historic habitat, two additional nonessential, experimental populations were established in the U.S. under section 10(j) of the Endangered Species Act (1973): one on Kofa NWR in 2013 (the Kofa Subunit), and one on BMGR-East east of Arizona State Highway 85 in 2015 (the Sauceda Subunit; USFWS 2016). The Pinacate and Quitovac populations (Management Units) of Sonoran pronghorn, managed by the Comisión Nacional de Áreas Naturales Protegidas (CONANP) and Comisión de Ecología y Desarrollo Sustentable del Estado de Sonora (CEDES), are found on 4,057 km^2 in northwest Sonora, Mexico (USFWS 2016).

Although approximately 35 million pronghorn roamed North America prior to European settlement (Nelson 1925), populations had dramatically decreased in both distribution and abundance by the late 1800s due to unregulated hunting and habitat loss and fragmentation (Yoakum 2004). A continent-wide survey effort in the early 1920s indicated there were 30,600 pronghorn in North America (Nelson 1925). Although not identified as a subspecies until 1945, Sonoran pronghorn likely experienced a similar pattern of decline caused by the same factors, as well as prolonged drought, habitat degradation associated with livestock grazing, and possibly novel livestock-borne disease (USFWS 2016). From 1892 to 1894, a survey of the international boundary documented pronghorn in every broad, open valley from Nogales, Mexico to Yuma, Arizona (USFWS 2016); most of these were likely Sonoran pronghorn. The 1920s survey provided the first abundance estimate of Sonoran pronghorn: 105 individuals in the U.S. and 595 in Sonora (Nelson 1925). The U.S. population ranged between 50 and 150 individuals from the 1940s to the 1980s, whereas the size of the Mexico population was more than 1,000 in the 1950s and between 250 and 350 in the 1980s and early 1990s (USFWS 2016). In the early 1990s, the Arizona Game and Fish Department (AZGFD) standardized field survey methods and developed a sighting probability model on which abundances of management units are currently based. This model accounts for imperfect detection of pronghorn during the survey by adjusting for group size, thereby providing a more accurate estimate of abundance

(Bright et al. 1999). The U.S. Fish and Wildlife Service (USFWS) and AZGFD started implementing biennial, range-wide aerial surveys of the Cabeza Management Unit in 1992, estimating 130-282 pronghorn in the U.S. during the 1990s (USFWS 2016; Figure 3). AZGFD and USFWS started conducting biennial, range-wide surveys of the Mexico populations in 2000. In 2007, AZGFD and USFWS transitioned to conducting surveys in the U.S. during even years and in Mexico during odd years due to the extensive time and effort required to successfully plan and implement each survey.

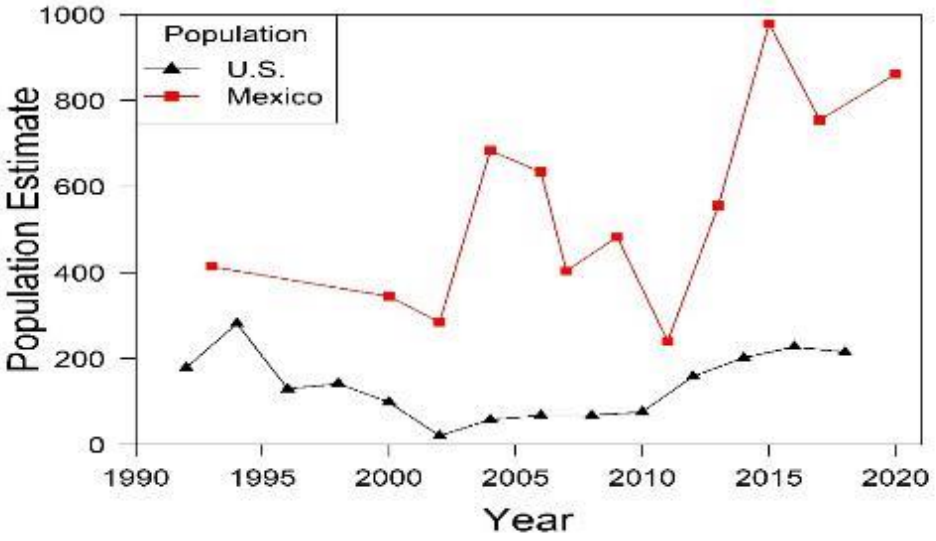


Figure 3. Sonoran pronghorn numbers in the US and Mexico (*J. Holland, CCTU*)

In 2002, the most severe drought recorded in southern Arizona almost led to extirpation of the U.S. population, which crashed to 21 individuals from about 99 in 2000. This dramatic decline motivated the implementation of previously planned recovery efforts, including a captive breeding program, construction of permanent water sources called drinkers, provision of supplemental forage near drinkers when range conditions are poor, and irrigation of native forage in important summer habitat.

The first captive breeding pen was constructed in 2003 on CPNWR. Internal fencing divided the 2.6-km^2 enclosure into a north and south half. The first breeder stock, two does, were brought to the pen from the Quitovac Management Unit in January 2004. A buck from the Cabeza Management Unit was captured and brought to the pen in April 2004. Additional breeding stock were brought from the Quitovac (two does and one buck) and Cabeza (seven does and two bucks) Management Units between 2004 and 2006. The first release of captive-born Sonoran pronghorn into the wild occurred in Fall 2006 and has continued annually. By 2011, USFWS had published a final rule to establish additional populations of Sonoran pronghorn in historic habitat to create two nonessential, experimental populations: the Kofa and Sauceda Subunits (76 Federal Register 25593). To facilitate reintroduction efforts, a second captive breeding pen 1.3 km^2 in area was established in 2011 on Kofa NWR. Managers brought 11 does and two bucks from the CPNWR pen to serve as breeding stock in the Kofa pen. The first wild Sonoran pronghorn were released into the center of the Kofa Subunit in January 2013. In January 2019, Sonoran pronghorn were released into the Kofa Subunit from a holding pen on the Yuma Proving Ground, managed by the U.S. Army. Releasing Sonoran pronghorn from this second area east of the original release site has expanded the portion of the Kofa Subunit occupied by Sonoran pronghorn. Managers first released Sonoran pronghorn into the western portion of the Sauceda Subunit in 2015. Overall, more than 300 individuals

have been released into the wild from the captive breeding pens. When defining survival as an individual living through the September after its release (about 9 months), mean annual survival of Sonoran pronghorn released from 2006 through January 2018 is about 71%. At present, the Kofa Subunit comprises about 120 adult Sonoran pronghorn and the Sauceda Subunit has 60. With the approximate 225 adults in the Cabeza Management Unit, 69 adults in the CPNWR pen, and 33 adults in the Kofa pen, there are about 305 wild and 102 captive adult Sonoran pronghorn in the U.S.

The relative success of the Sonoran pronghorn captive breeding program, as evidenced by the gradual increase in abundance of the Cabeza Management Unit (Figure 3), can be attributed to concurrent efforts to improve habitat quality. The Cabeza Management Unit lacks any natural permanent source of water within Sonoran pronghorn habitat. Naturalists in the early 1900s generally presumed Sonoran pronghorn were capable of meeting water requirements through forage intake (Morgart et al. 2005). A limited number of waters were developed for Sonoran pronghorn from 1956 – 1987, but their lack of use led some wildlife biologists to conclude that Sonoran pronghorn did not need to drink. After studying habitat selection of Sonoran pronghorn and documenting their use of other anthropogenic and natural water sources, however, wildlife biologists learned that the original waters were not located within summer habitat or were not designed properly to accommodate Sonoran pronghorn (e.g., drinking greatly restricted a Sonoran pronghorn's ability to monitor its surroundings; Morgart et al. 2005). Since 2002, 17 permanent water sources called drinkers, specially designed for Sonoran pronghorn, have been constructed within the Cabeza Management Unit. Sonoran pronghorn regularly use 13 of these drinkers. At six drinkers, supplemental forage in the form of alfalfa hay is provided when habitat conditions are poor, generally from mid-May until arrival of the monsoon rains in July. The number of pronghorn foraging and watering at each site varies from year to year, but has exceeded 40 individuals at one site. Five forage enhancement plots, three of which also have permanent drinkers, were built in the Cabeza Management Unit. Two are fully functional, and irrigation keeps forage plants green during dry periods. Motion-activated cameras have photographed Sonoran pronghorn feeding on native vegetation at these sites (Figure 4).

Figure 4. Sonoran pronghorn photographed in a camera trap (© *the authors*)

To further recovery in the next year, the Sonoran Pronghorn Recovery Team is planning to reintroduce Sonoran pronghorn to Vekol Valley on the Sonoran Desert National Monument, managed by the BLM. Vekol Valley is located on the east side of the Sauceda Subunit. Furthermore, the Recovery Team hopes to translocate six Sonoran pronghorn to the Pinacate Management Unit in fulfillment of an obligation to Mexico; in exchange for the Sonoran pronghorn from the Quitovac Management Unit used to start the captive breeding program, the U.S. agreed to return an approximately equal number to Sonora when appropriate given recovery objectives. The Recovery Team is also working with the California Department of Fish and Wildlife and other partners to reintroduce Sonoran pronghorn to 5,166 km^2 in southeast California within the next several years (Figure 2).

The abundance of Sonoran pronghorn is greater in Mexico than in the U.S. (Figure 3), and efforts towards recovery also differ. The Pinacate Management Unit occurs within the Reserva de la Biosfera El Pinacate y Gran Desierto de Altar (El Pinacate), which consists of federally owned and protected lands managed by CONANP as well as private land and ejidos (communally owned lands). The Quitovac Management Unit, comprising the majority of all Sonoran pronghorn, occurs entirely within unprotected lands, including a mixture of private land and ejidos. CONANP has removed unused fencing within El Pinacate to minimize barriers to movement. In 2015, nine waters tanks were installed for Sonoran pronghorn, seven in El Pinacate and two in Quitovac. Although Sonoran pronghorn have not been documented drinking from these waters, the locations may not have been ideal due to limited data on habitat use, and design restrictions (e.g., fencing to restrict cattle) may have precluded use by pronghorn. The expansion of three mines also threatens Sonoran pronghorn in the Quitovac Management Unit (USFWS 2016). Although CEDES has coordinated with the mines to transplant cholla, a forage plant important to Sonoran pronghorn, the efficacy of this mitigation effort is unknown.

Overall, recovery efforts in both the U.S. and Mexico have helped make progress towards meeting objectives for recovering Sonoran pronghorn, as specified by the six downlisting criteria (USFWS 2016):

1) Viability of at least three free-ranging populations
2) Preservation of connectivity within existing management units and subunits
3) Stabilization or decline of threats to habitat quality
4) Minimization of human disturbance
5) Maintenance of genetic diversity
6) Laws prohibiting unrestricted killing of Sonoran pronghorn.

Peninsular Pronghorn Recovery Program

Victor Sánchez[1], Josef Warman[2], Felipe Ramírez[2,] Jeff Holland[3,] Kevin Clark[4], Aidée Sánchez[2], Martin Gutierrez[5]

[1]*Valle de los Cirios Flora and Fauna Protected Area and PRBP Head coordinator;* [2]*Espacios Naturales y Desarrollo Sustentable A.C.;* [3]*Center for the Conservation of Tropical Ungulates*
[4]*San Diego Natural History Museum;*
[5] *Programa de Naciones Unidas para el Desarrollo*

The peninsular pronghorn (*Antilocapra americana peninsularis*) (Figure 1) is one of three subspecies of pronghorn found in North America (Byers, J.A., 2011). This ancient species is the last of their kind, being the only genus and species in the family *Antilocapridae* to have survived the end-Pleistocene extinctions.

Figure 1. Male peninsular pronghorn in La Choya, El Vizcaino Biosphere Reserve (© *Houston Zoo*)

Historically the peninsular pronghorn was found in their hundreds distributed over a wide region of the Baja California Peninsula, from the bays of San Felipe, San Quintín, Bahía de los Ángeles, El Vizcaíno, south to Magdalena Bay (Nelson, 1925) (Figure 2).

Figure 2. Historical and actual range of the peninsular pronghorn (© *A. Cottulenc*)

Threats like, drought, illegal hunting, land-use change, habitat fragmentation, coyote predation and competition with free-ranging domestic livestock greatly reduced their population numbers (Figure 3) and were listed as Endangered by both Mexico and the United States and are listed on Appendix I of CITES. In 1993, based on land and aerial surveys carried out by Mexico´s Federal Environment and Natural Resources Secretariat (SEMARNAP), the wild peninsular pronghorn population was estimated at no more than 200 individuals. By 1997, the population had decreased to 150 individuals.

Figure 3. Burros free-ranging in Valle de los Cirios Protected Area, BC, Mexico (© *Jeff Holland*)

The Vizcaino Desert, which makes up the majority of the "Valle de los Cirios" and "El Vizcaino" Biosphere Reserve (together they form 5 million ha of the largest protected area in Mexico), is one of the most remarkable and diverse deserts in the world (Figure 4). The flora and fauna of this Sonoran Desert province is unique and diverse, with 496 plant species, 69 species of mammals, 43 species of reptiles and 192 species of birds. Even among deserts it is particularly harsh with little to no rain, constant sun, and unrelenting winds from NW-SE. But this desert is considered a fog desert, caused by the cold waters of the California marine current that condense a significant amount of dew that maintains xeric exuberant vegetation types. However, in the specific case of the peninsular pronghorn population, the typical vegetation in which it is found is the xerophilous shrub (Figure 5). Specifically, the *inerme* shrub, the dune shrub, the *halophilic* shrub and the *microphilic* shrub (INEGI).

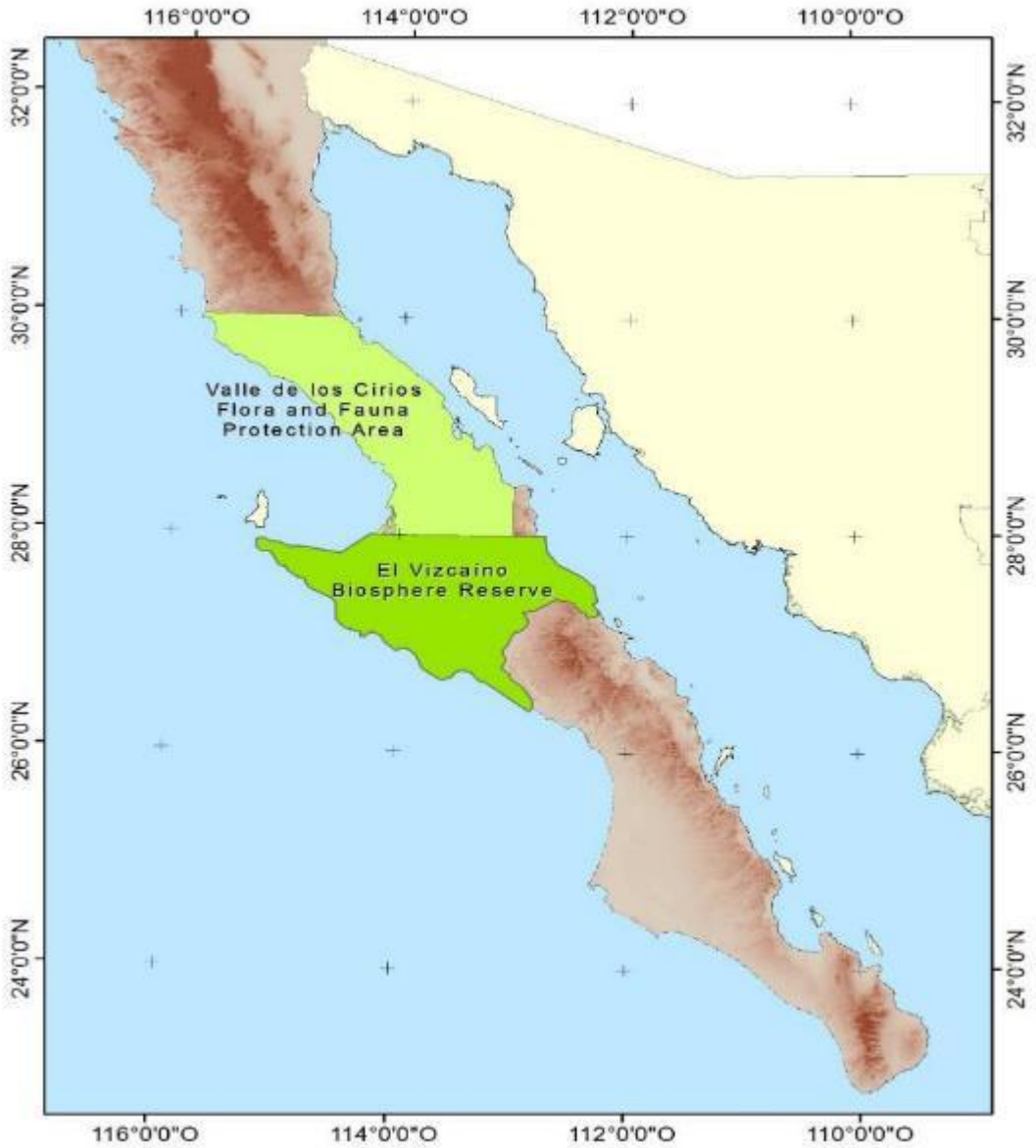


Figure 4. Valle de los Cirios Protected Area and El Vizcaino Biosphere Reserve (© *Fernando Escoto*)

Figure 5. Peninsular Pronghorn Habitat in the El Vizcaino Biosphere Reserv*e (© Jeff Holland*)

Due to the continuing decline of the peninsular pronghorn, Mexico´s Federal Government planned to save the pronghorn by increasing their numbers through captive breeding and eventual reintroductions.

In March of 1997 SEMARNAP and Espacios Naturales y Desarrollo Sustentable (ENDESU), an NGO in Mexico, initiated the Peninsular Pronghorn Recovery Project (PPRP) with two specific objectives:

1) Achieve the recovery of the peninsular pronghorn population through intensive captive management, while maintaining the maximum possible genetic viability.

2) Achieve the recovery of the historic pronghorn habitat, taking into consideration the environmental, economic, and social reality of the current conditions.

The program was launched in 1998 with the capture of five newborn wild pronghorn fawns that were hand reared (Figure 6). These first pronghorn were released into a 350-hectare corral dedicated to pronghorn captive breeding. An additional 12 more fawns were captured, and hand reared over the following years. During this period, 30 more adults were passively captured through a corral trap to increase the genetic diversity of the founder herd.

Figure 6. Hand-reared Pronghorn fawns with Vicente, PPRP Staff (© *Jeff Holland*)

By 2006 the captive population of peninsular pronghorn had increased to 198 individuals and at this time it was recognized that the entire future of the peninsular pronghorn was in one facility. The idea of "having all your eggs in one basket" was a great concern for the PPRP should there be a disease outbreak or some type of natural disaster that could potentially reduce the captive population significantly. Therefore, it was decided that an assurance population should be established at select AZA Zoological Institutions in the United States.

Since 2002 the Los Angeles Zoo, Living Desert Zoo and Gardens and San Diego Zoo Global have been working with the PPRP helping with husbandry, management, and veterinary care for the captive population. In July 2006 four pronghorn fawns were flown from the Captive Breeding facility in Baja to the Los Angeles Zoo to establish this assurance population. In 2011 an additional five fawns (1.4) were imported to the Los Angeles Zoo in order to increase the founder base of the US captive population. As of 2020 the US Zoo population numbers 47 (24.23) animals distributed among seven zoological institutions in California, Arizona, and Texas.

By 2010, the PPRP managed pronghorn herd had increased to 250 individuals. However, the wild population was thought to have vanished from the El Vizcaíno landscape as no further sightings were reported in 2010. That same year efforts were begun to reintroduce the peninsular pronghorn to their historic habitat, following negotiations and agreements with local ejidos (social land tenure in México), and the state governments of Baja California and Baja California Sur. A corridor of natural and semi-developed fragmented areas of appropriate habitat was created. The conservation of pronghorn depended on the determined participation of the owners of the land, especially the ejidos and for this reason agreements were established between ENDESU and four other ejidos, which yielded 54 thousand hectares of pastureland divided into three enclosed and livestock-free estates that covers a flat, topographically simple surface, between the parallel 28ºN, 113º18”E, 26º47”Sand 114º30” W (Cancino et. al. 1995) (Figure 7).

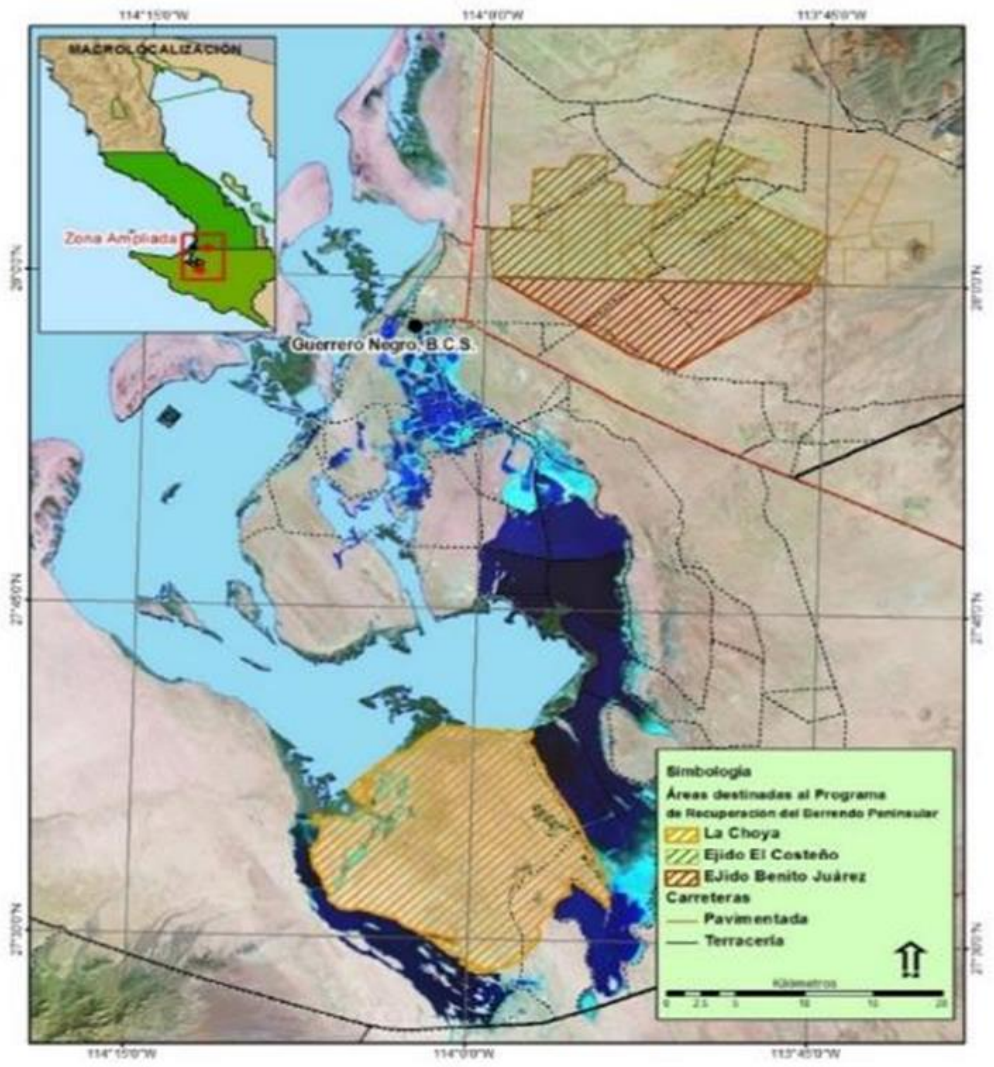


Figure 7. Fifty-four thousand hectares of pastureland divided into three enclosed and livestock-free estates (© *Fernando Escoto*)

During the 2010 season the captive breeding facility for the pronghorn was relocated to a new site within an area known as Estación La Choya. Two hundred pronghorn were relocated to this new site. A group of 18 pronghorn were unable to be captured for transfer and were released from the breeding pens, which initiated the reintroductions for that year.

An aerial survey in 2012 that surveyed 400,000 hectares of the El Vizcaino Desert counted only 15 individuals (Lee R., 2012) and it was presumed that these 15 individuals were from the group of 18 released back in 2010 as their recorded location was very close to the old captive breeding facility. This also reinforced the thought that the species was indeed vanished in the wild as of 2010. In 2016 another aerial survey was conducted, and 27 individuals were counted (Lee, R., 2016). In the last census, conducted in January 2020, a significant population increase was observed in the wild, with 60 specimens counted (Lee, R., 2020) (Figure 8). In all the censuses following Lee's methodology, only 45% of the total population evaluated is observed. This last figure indicates a potential population estimate of 100-130 specimens in the wild. Currently the PPRP manages 650 peninsular pronghorns across four captive populations (Figure 9) including the wild reintroduced population. Although the management and protection of the wild population was not one of the mandates of the PPRP, in 2017, they were given the necessary authority to coordinate the management, monitoring and surveillance of the wild population through the active participation of the ejidos.

Figure 8. Peninsular pronghorn survey in El Vizcaino Biosphere Reserve (© *Martín Gutiérrez*)

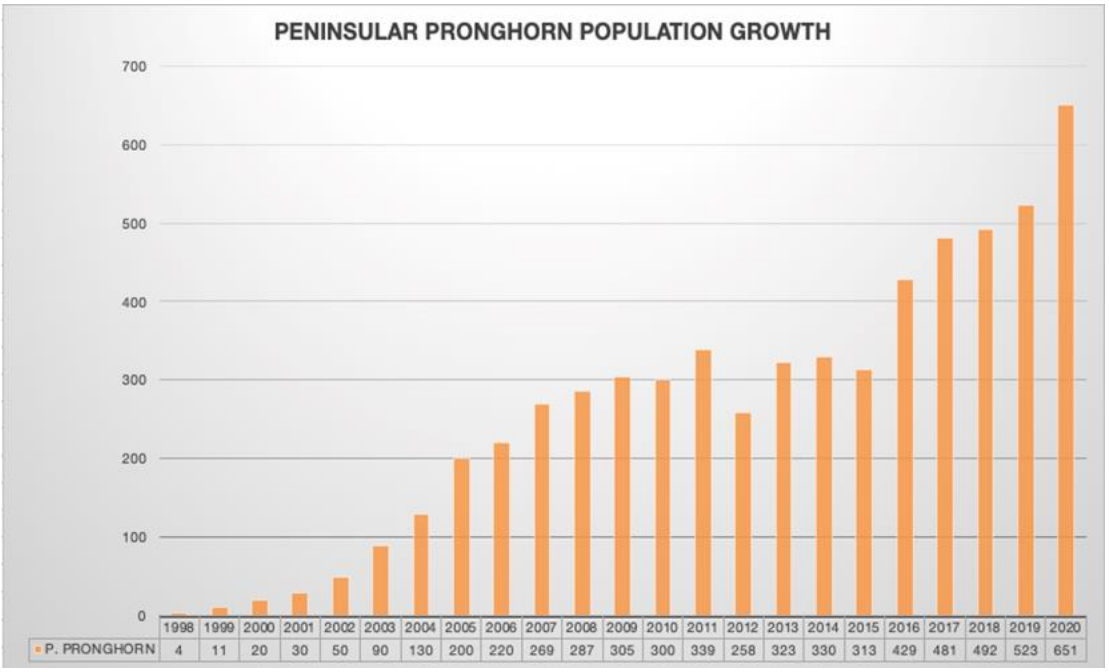


Figure 9. Peninsular pronghorn population growth within the PRBP (© *Martín Gutiérrez*)

Species Action Plan Workshop

In January of 2020, an IUCN lead Species Action Plan workshop was held at the PPRP Visitor Center in the Valle de Los Cirios Protected Area. This workshop, held over three days, brought together all the partners and stakeholders including SEMARNAT, CONANP, ENDESU, ejido Benito Juárez, ejido El Costeño, ejido Matarranchos, USFWS, San Diego Natural History Museum, Los Angeles Zoo, Living Desert Zoo and Botanical Garden and San Diego Zoo Global (Figure 10).

The workshop focused on developing an Action Plan for the next five years. The primary objectives for the program are as follows:

1) Habitat Protection
2) Secure and Expand Wild Pronghorn Populations
3) Improve production of semi-captive populations
4) Improve PPRP Infrastructure
5) Import New Founders to the US Captive Population
6) Increase the US Captive Population
7) Reintroductions to Southern California Sites
8) Reintroductions to Baja California Sites
9) Community based Education
10) Increase Fundraising

This Species Action Plan will be used to help guide the PPRP in the future conservation of the peninsular pronghorn, particularly in identifying new historical pronghorn habitat for reintroductions. Recent genetic evidence suggests that the peninsular pronghorn distribution extended north at least to the U.S.-Mexico border, and likely further (Hahn et al. 2020).
All six historical museum samples analyzed from Baja California, during this study, revealed both nuclear and mitochondrial DNA sequences were most like the peninsular subspecies. This

includes specimens from the Laguna Salada region just south of the border. Given the lack of barriers to movement in this region, it is likely that the Peninsular pronghorn ranged up into Southern California both in coastal and desert habitats.

Several areas in southern California have already been identified as potential reintroduction sites for peninsular pronghorn based on this information. Further habitat assessments and discussions with local, state and federal agencies will be needed before any determination is made on whether peninsular pronghorn will return to the deserts of southern California. Additionally, more land is being set aside in Baja California through the agreements with the ejidos, thus potentially increasing the size of the available land to peninsular pronghorn conservation.

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Antelopes in Bamingui-Bangoran National Park, Central African Republic: Response to Anon (2018) and Anon (2019)

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The report in *Gnusletter* (Anon 2019) contains a number of errors in the introduction. The Bamingui-Bangoran National Park in the Central African Republic was created in 1933, not 1993, and covers 11,560 km^2 including the Vassako-Bolo Integral Reserve which forms the central core of the Park. It is one of the few national parks encompassing this separate designation comprising an area of 860 km^2 in accordance with the original recommendations for creating national parks. The Park was given the paper status of Biosphere Reserve in 1979, encompassing with the surrounding area 16,220 km^2. A brief description of the habitat of the Park is given in Spinage (1988). The report on the foot survey of the larger fauna of the Bamingui-Bangoran National Park conducted by the project Ecofaune in March-April 2018 also poses some points requiring clarification.

Bongo (*Tragelaphus eurycerus*) have never before been recorded in this park which is predominantly *Terminalia-Combretum* woodland, lacking suitable dense habitat for bongo. The observation appears to have confused some other species, probably giant eland (*Tragelaphus derbianus gigas*) or yellow-backed duiker (*Cephalophus sylvicultor*), although the bongo is four times the size of the latter but interpreting what a game ranger may say is not always easy. Neither has the giant forest hog (*Hylochoerus meinertzhageni*) been recorded there before, possibly a confusion with a dark red river hog (*Potamochoerus porcus*) of which I found remains but never sighted one, although this is claimed by Green (pers. comm.). Again, it lacks the right habitat for giant forest hog. The black-fronted duiker (*Cephalophus nigrifrons*) is also a forest species and this seems to be a confusion with the red-flanked duiker (*C. rufilatus*).

The report further notes not having encountered sitatunga (*Tragelaphus spekei*). Again, there is no suitable habitat for this species in the Park. The greater kudu (*Tragelaphus strepsiceros*) has only ever been recorded in the Central African Republic from the Delembé and Choc-choc hills some 350 km to the east (Spinage 1981). Cheetah (*Acinonyx jubata*) has never been recorded from the area, it is not a habitat in which cheetah could hunt although climate and human disturbance may have driven it below the 9^0 parallel which touches the northern limit of the Park, which Malbrant (1936) gave as the cheetah's southern limit. The topi (*Damaliscus lunatus lyra*), which is not the subspecies tiang (*D. l. tiang*), was recorded here by Spinage (1988). Green (1983) reported seeing two ostrich (*Struthio camelus*) in 1981 at Avakaba in the north-east of the Park, and according to local knowledge they were formerly present in the west of the Park, but I would not consider it suitable habitat. The report fails to mention the black rhinoceros (*Diceros bicornis*) which formerly was not uncommon (in excess of 100) in the area (Spinage 1986, 1988).

Results of an aerial survey conducted by FAO in August 1977 and previously unpublished are given in Table 1 (this was with a low-wing aircraft and the results were undoubtedly underestimates as shown by the high 95% standard error where this could be applied). The Vassako-Bolo Integral Reserve was calculated separately from the Park area. The FAO project was terminated before ground-truthing surveys could take place. It should not be deduced from Table 1. whether increases or decreases have taken place between 1977 and 2018, but the persistence of species is encouraging.

Table 1. Comparison of observations in the Bamingui-Bangoran National Park 1977 and 2018

Species	Bamingui-Bangoran National Park Estimated Total	Vasako-Bolo Integral Reserve Estimated Total	Maximum Total	2018 Survey
Elephant	1160 +/- 350	180	1690	<100
Buffalo	6480 +/- 3590	540 +/- 410	12610	2000-100
Black Rhinoceros	130 +/- 60	40	230	
Giraffe	0	50	50	<100
Hartebeest	4240 +/- 700	350 +/- 100	5390	>2000
Topi	90	0	90	
Waterbuck	290 +/- 150	0	440	2000-100
Buffon's kob	2070 +/- 830	0	2900	2000-100
Roan antelope	290 +/- 100	330 +/- 100	820	>2000
Giant eland	820 +/- 560	0	1380	>2000
Hippopotamus	60	0	60	<100

Topi were always of restricted distribution in one small area of the Park first recorded by Spinage (1988), also occurring in small numbers to the west of the Bamingui River in the Bamingui-Gribingui Faunal Reserve (Malbrant1936). Hippopotamus were known to occur at only two points in the Bamingui River within the Park and thus were very vulnerable to poaching (Spinage *et al.* 1977).

Of the larger mammal species recorded as present in the 2018 survey and recorded by Spinage (1988), but numbers not estimated, all were matched with the exception of the black-fronted duiker, bongo, and giant forest hog, all forest species which are unlikely to be present. Species recorded by Spinage (1988) but not the 2018 survey, were crested Mona monkey (*Cercopithecus pogonias grayi*), DeBrazza's monkey (*C. neglectus*), giant pangolin (*Manis tricuspis*), striped hyaena (*Hyaena hyaena dubba*), aardvark (*Orycteropus afer*), yellow-backed duiker, black rhinoceros, and red river hog.

Giraffe (*Giraffa camelopardalis*) are never likely to have been numerous in the Park. The *Terminalia-Combretum* woodland is obstructive to vision and the open grassland areas are waterlogged during the wet season. Some extensive laterite shields offer solid open areas in the wet season, but congregating on them would expose the giraffes to predation.

Figure 1. Giant eland in *Terminalia-Combretum* woodland in the Bamingui-Bangoran National Park, mid-1970s (© *C.A. Spinage*)

Figure 2. Photograph of the now extinct western black rhinoceros in the Bamingui-Bangoran National Park, early 1970s (© *C.A. Spinage*)

Figure 3. Elephant in the Bamingui-Bangoran National Park, 1970s (© *C.A. Spinage*)

Figure 4. A lateritic shield in the Bamingui-Bangoran National Park (© *C.A. Spinage*)

Figure 5. Trail blazing in the Bamingui-Bangoran National Park before the advent of GPS, early 1970s, showing typical *Terminalia-Combretum* woodland (© *C.A. Spinage*)

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Status of Hirola in Ishaqbini Hirola Sanctuary

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Summary

This report provides an update on the status of the hirola population in the Ishaqbini Conservancy predator-proof sanctuary up to December 2019. Analyses are based on data gathered by Ishaqbini community conservancy scouts using the Wildlife-CoMMS monitoring system. Scouts gather information on age and sex of all hirola herds encountered, inside and outside the sanctuary, and record new births and deaths. More details on Wildlife-CoMMS are provided in previous reports. Due to security constraints NRT was unable to carry out an aerial survey in Ishaqbini in 2019 to verify the population estimates based on births and deaths reported by conservancy scouts.

The sanctuary was established in August 2012 with a founder population of approximately 48 hirola. At the end of December 2019, the estimated population inside the sanctuary was 118-130 individuals; this represents approximately 25% of the remaining population of hirola in

Kenya. Population growth in the sanctuary in 2019 was only 2%, as a result of births and deaths being almost equal. Apart from 2016, when there was a severe drought which resulted in the deaths of 25 hirola inside the sanctuary, 2019 recorded the lowest annual population growth rate to date. This is likely due to social and ecological constraints to the population with the sanctuary having reached carrying capacity.

- Population has increased from approximately 48 hirola when the sanctuary was established in 2012, to approximately 118-130 individuals in December 2019.
- Average annual population growth was 21% in the first 3 years (2013-2015). Following the 2016 drought, the population recovered and showed a 17% and 15% annual growth in 2017 and 2018 respectively, however it decreased to only 2% growth in 2019.
- Since late 2017, breeding season has shown a more pronounced bi-modal pattern associated with rains in March – May and October – December (except for Oct-Dec 2019 when only 1 birth was recorded), compared to breeding throughout the year which was observed in 2015 and the first half of 2016.
- Proportion of sightings of adult females to adult males has changed from 3.3:1 in 2013 to 2.2:1 in the 2019 (F:M sex ratio decreased to less than 2:1 in 2016, 2017 and 2018).

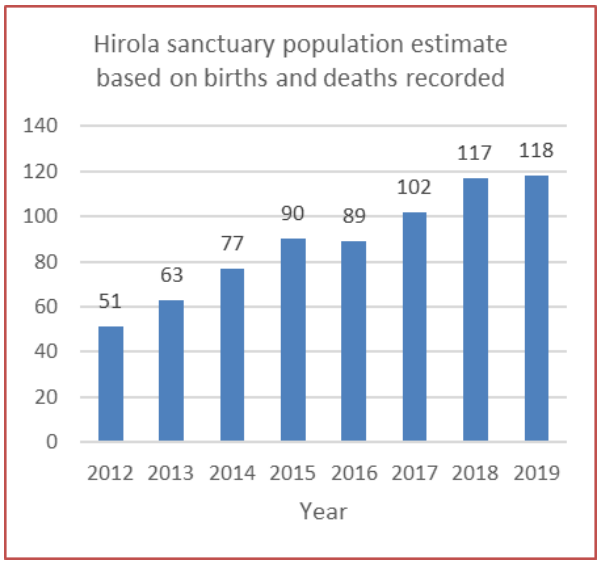
The priority is to expand the area of the sanctuary in order to accommodate the growing population and maintain a higher population growth rate. Expansion of the sanctuary has been approved by the Ishaqbini Conservancy Board and initial funding for fencing and other infrastructure has been secured, with the aim to start construction of sanctuary expansion fence in the second half of 2020. Removal of bachelor male herds from the sanctuary will also be explored as an option to increase the female to male sex ratio of the sanctuary population, reduce intra-specific competition between males and potentially increase breeding rates.

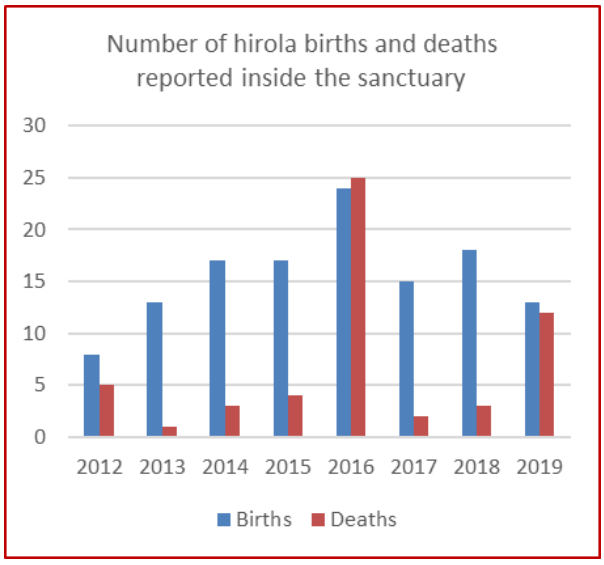
	Sanctuary 1st 4 years	**Sanctuary 7th year (2019)**	**Outside 2013-2019**
Adult sightings	72%	72%	90%
Sub-adult sightings	8%	18%	7%
Calf sightings	20%	10%	3%
Ratio of sightings Adult F : Adult M	2.6 : 1	2.2 : 1	2.4 : 1
Average herd size	7.5	8	6
Maximum herd size	23	23	27
Average annual population growth	20%	2%	Unknown
Estimated population size	97	118-130	16-33 *

** Estimated population size of hirola in aerial survey in Block A which includes Ishaqbini core conservation area and eastern bank of Tana River National Primate Reserve. Aerial survey estimates for hirola in Block A: 2014 – 26; 2016 – 33; 2017 – 16. Population estimate by Ishaqbini rangers in 2019 was 20 individuals.*

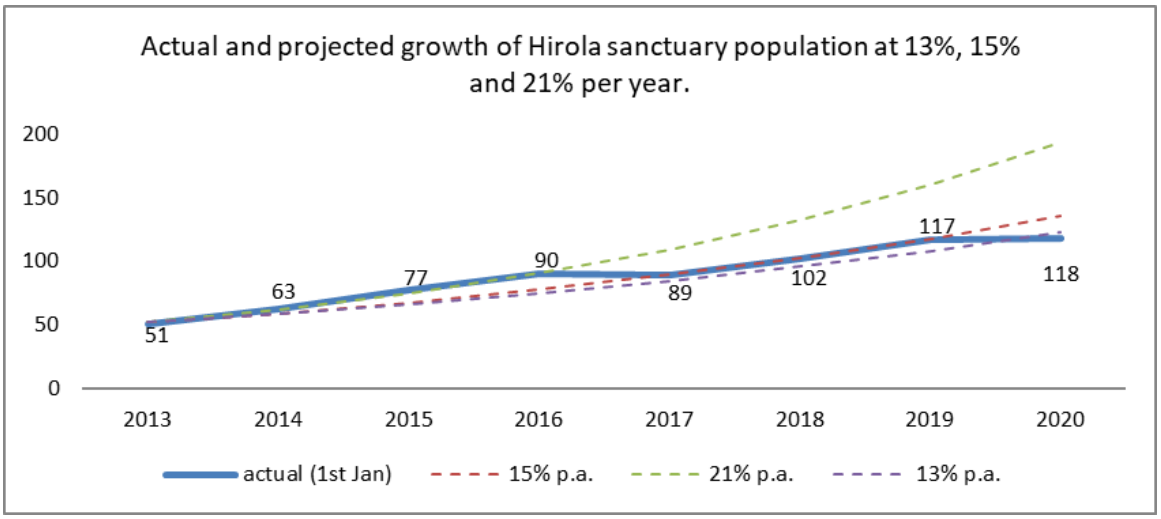
Population Growth

Population size based on records of births and deaths inside the sanctuary is estimated at 118 individuals at the end of 2019. However, this is likely to be an underestimate as aerial surveys have consistently given slightly higher numbers (an average of +12). The population within the sanctuary at the end of December 2019 was therefore likely to be within the range of 118 – 130 individuals. There were 13 births and 12 deaths in the sanctuary in 2019 resulting in only a 2% population growth. Deaths of 7 adults and 5 juveniles were reported in 2019. Several adult deaths in 2019 were due to fighting (intra-specific competition) and several juveniles were killed by a leopard which entered the sanctuary by jumping over the fence, it has since gone back outside. Other causes of death were not known.





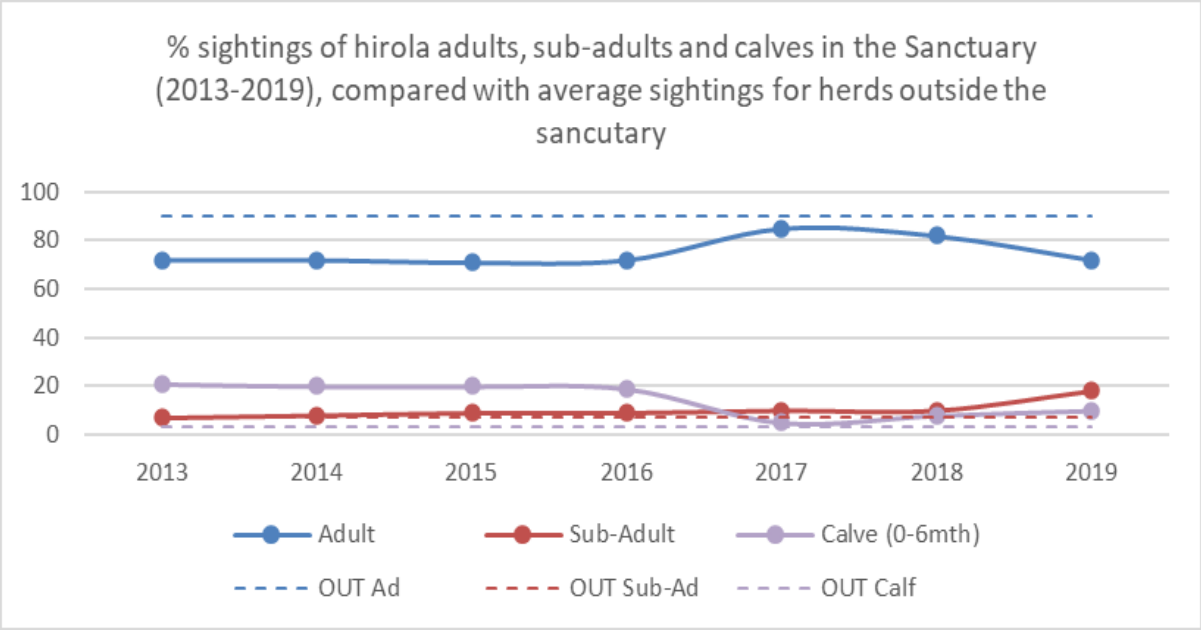
The average annual growth rate of the population since the sanctuary was established (2013-2019) is 13%. Growth rate in the first 4 years of the sanctuary was as 20% per year, this dropped in 2016 due to the drought, but recovered in 2017 and 2018. The low population growth rate in 2019 of only 2% is not well understood, however it may be due to ecological and social factors with the sanctuary likely to have now reached carrying capacity. Intra-specific competition is an indication of over-crowding in the sanctuary, although this has been reported periodically since the sanctuary was established.



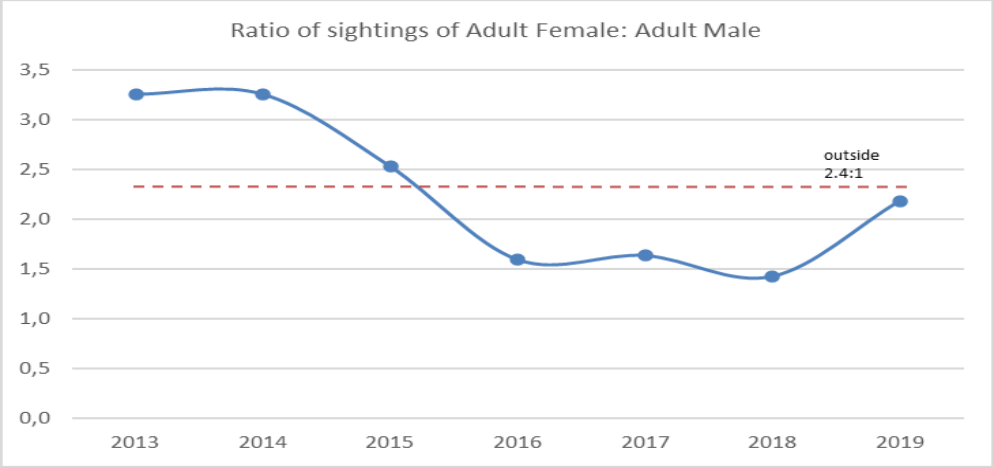
Population Demography

Monitoring the age and sex structure of the hirola population is carried out by Ishaqbini conservancy rangers on a daily basis for all herds encountered. This enables us to determine how the demography of the sanctuary population is changing over time.

Analysis of data is based on the proportion of sightings of different ages and sexes. Data shows that in the first four years of the sanctuary (up to 2016) the proportion of sightings of adults was approximately 72%, with 20% of sightings calves less than 6 months old, and 8% of sightings were sub-adults (6 months – 2 years old). However, following the drought in 2016 the demography of the population changed with a significant decline in sightings of calves in 2017 to only 5% due to the impact of the drought on female reproduction and survivorship of calves. Sightings of calves has slightly recovered in 2018 and 2019 but is not yet up to pre-drought levels. Sub-adult sightings have continued to increase and in 2019 are double what they were in 2013-2016 (pre drought). A comparison with the demography of hirola outside the sanctuary shows that % sightings of calves and sub-adults has consistently been lower outside than inside the sanctuary, except in 2017 following the drought. This is possibly due to low birth rates and/or survivorship of calves outside the sanctuary.



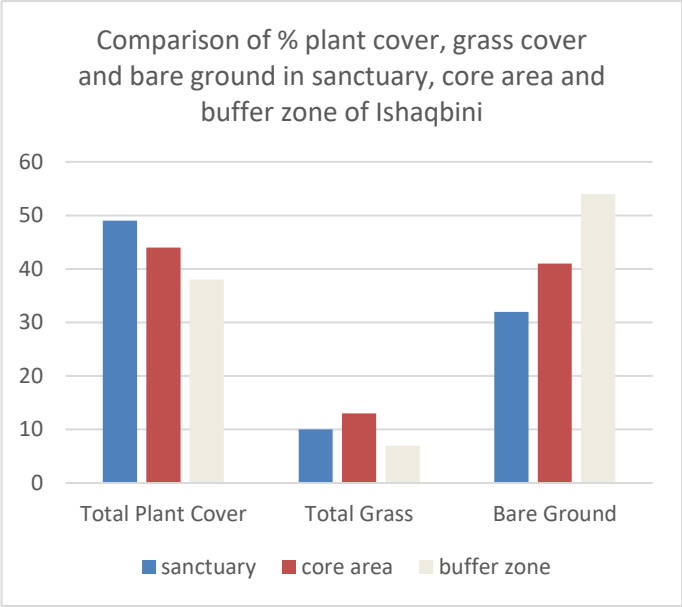
The ratio of sightings of adult females to adult males in the founder population was 3.3 females to 1 male; this declined to less than 2 females to 1 male in 2016-2018 and increased slightly to 2.2 females to 1 male in 2019. There is an increasing proportion of males in the sanctuary population. Of concern, is that since 2016 the ratio of adult females to adult males is lower inside the sanctuary than the average ratio for the population outside the sanctuary. The fenced sanctuary means that males are unable to disburse as they would in free-ranging populations, and it is likely that high numbers of males inside the sanctuary is exacerbating intra-specific competition and reducing the breeding potential of the population.



Habitat & Wildlife Management

Habitat improvement within the Ishaqbini sanctuary has been ongoing. This involves management and clearing of *Acacia reficiens* an invasive tree that creates thick stands of dense bush under which grass growth is suppressed. In 2019, 100 ha of *A. reficiens* was cleared inside the sanctuary; a total of 300 ha of bush has been cleared in the sanctuary since 2017 in order to improve habitat and grass cover specifically for hirola. Observations by rangers show that hirola and other wildlife are utilizing the cleared sites for grazing and recovery of grasses in these areas is evident. Removal of alien invasive plants including *Opuntia* and *Prosopis juliflora* from the sanctuary is also ongoing.

Monitoring of vegetation is done annually by Ishaqbini rangelands coordinator during the wet season at fixed transects within the sanctuary and outside (using NRT's Vegetation-CoMMS system). Data from 2018 vegetation monitoring shows total plant cover was highest in the sanctuary compared to the core conservation area and buffer zone; grass cover was highest in the core conservation area followed by the sanctuary and buffer zone; and bare ground was lowest in the sanctuary (high bare ground is an indicator of poor rangeland condition and high erosion potential).



Reducing densities of other wildlife in the sanctuary is necessary in order to reduce competition with hirola for forage and water, maintain optimal densities for habitat management, reduce parasite loads (which increase in areas with high densities of animals) and avoid high mortality during droughts. A system to remove other wildlife from inside the sanctuary was built into the fence, with an enclosure that can be separated from the main sanctuary using a two-way gate system, enabling wildlife inside the enclosure to be released outside the fence. Wildlife is attracted into the enclosure mainly in the dry season through the provision of a permanent water source, rangers are then able to close the internal gates and open the external gates to release

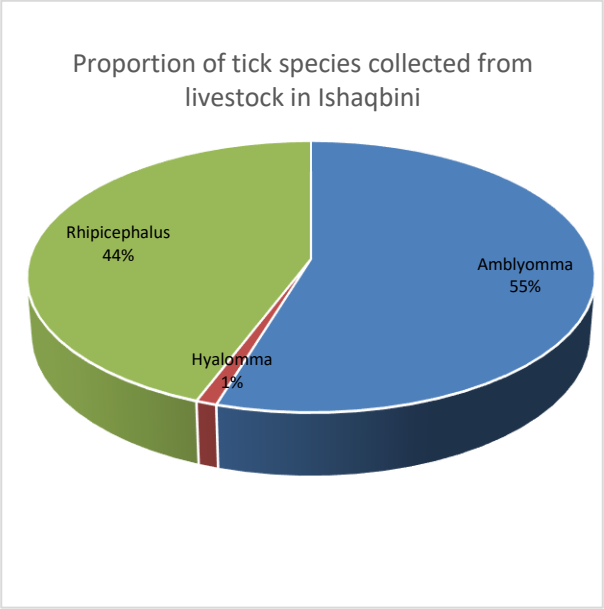
wildlife. A total of 44 individual animals have been removed from the sanctuary in this way since 2018 including 33 Giraffe, 9 common zebra, 1 buffalo and 1 lesser kudu.

Disease Surveillance & Management

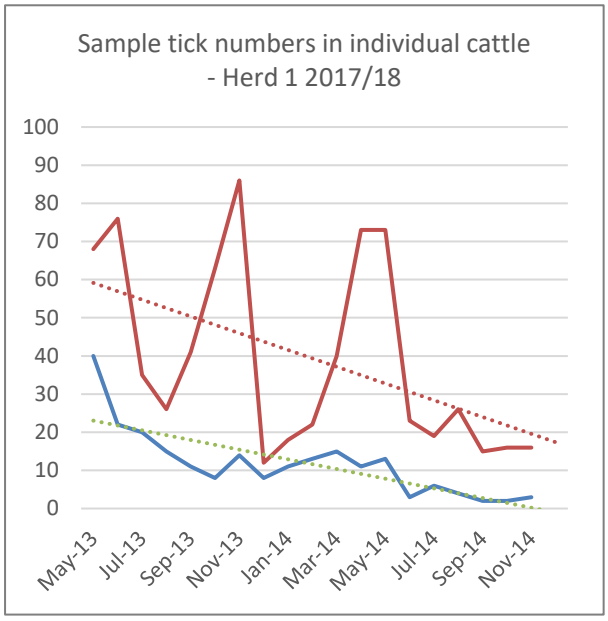
NRT with support from San Diego Zoo Global have established a disease surveillance and management program for the hirola sanctuary. Since 2016 this has included an annual vaccination campaign of livestock in Ishaqbini (with initial support from Disney Conservation Fund and St Louis Zoo) carried out in partnership with the Ministry of Livestock. The aim is to reduce disease outbreaks in livestock and reduce the risk of disease transmission from livestock to hirola and other wildlife thereby creating a 'disease-free' buffer around the sanctuary. In 2019, 63,000 head of livestock (19,400 cattle and 43,700 sheep and goats) were vaccinated against viral Peste des petits ruminants (PPR) and bacterial (anthrax, black-quarter, contagious caprine pleuropneumonia, contagious bovine pleuropneumonia) diseases that have the potential to spill over to hirola. Livestock also received acaricide spray as a measure towards controlling tick loads. 232 households benefitted from the 2019 vaccination campaign. A focused group discussion with community members revealed that common priority diseases and conditions affecting livestock in Ishaqbini are; trypanosomiasis, ticks & tick-borne diseases, contagious bovine pleuropneumonia (CBPP), contagious caprine pleuropneumonia (CCPP), black-quarter, Peste des petits ruminants (PPR), Foot and Mouth Disease (FMD), Capripox (sheep pox, goat pox & lumpy skin disease).

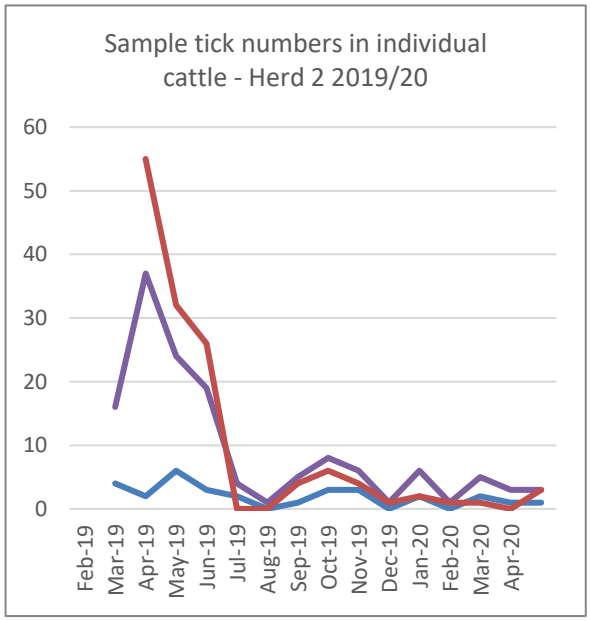
Tick samples were collected from community livestock and cattle inside the sanctuary. The following ticks were identified:

- ***Amblyomma gemma*** – 55% of ticks found; responsible for transmission of heart water to cattle, sheep and goats.
- ***Hyalomma rufipes*** – 1% of ticks found; transmits Crimean-Congo haemorrhagic fever in humans, *Anaplasma marginale* to cattle causing bovine anaplasmosis, and the bacterium *Rickettsia conorii* causing tick typhus in humans. Adult ticks cause wounds leading to the formation of severe abscesses.
- ***Rhipicephalus pulchellus*** (zebra tick) – 44% of ticks found; transmits Nairobi sheep disease virus, tick typhus, *Theileria taurotragi* to eland, and *Babesia equi* to zebra.



A small herd of cattle that are herded within the sanctuary, these are used as a means to reduce tick densities in the sanctuary through regular application of acaricides. The current application is: 3 doses of "Norotraz" at weekly intervals followed by 1 dose of "Ectopor" at a weekly interval. Since 2017, Ishaqbini and NRT have been gathering data on tick loads on a sample number of these cattle (and a sample area around the eye or ear of specific cows) to determine whether tick loads and densities inside the sanctuary are decreasing. Results are shown below for different cattle in 2 herds; results clearly show that tick numbers on cattle have decreased which suggests that tick loads in the sanctuary are also decreasing with the use of acaricides on cattle.





In early 2020 with support from SDZG, Ishaqbini recruited a full-time Veterinary Technician who will be responsible for monitoring disease in livestock and wildlife and providing support to community members on livestock health.

Sanctuary Expansion Plans

Since 2015, NRT has been in discussion with Ishaqbini Conservancy Board and Management regarding the future of the sanctuary hirola population once the sanctuary reaches carrying capacity. Different options have been discussed at length including: removal of excess hirola to the surrounding area, habitat improvement within the sanctuary to increase carrying capacity, expansion of the sanctuary to the west into the Tana Primate Reserve and Ndera Community Conservancy, and expansion of the sanctuary to the east remaining within Ishaqbini.

The final decision to expand the sanctuary to the East was agreed with the Ishaqbini Board in 2019 and NRT embarked on a fundraising campaign to raise the funds needed for the sanctuary expansion. An environmental and social impact assessment (ESIA) has been completed and submitted to the National Environment and Management Authority (NEMA) and is awaiting final approval. The Ishaqbini Board have undertaken widespread community awareness and sensitization which is ongoing, to ensure there is a full understanding and agreement of the expansion area among the entire Ishaqbini community. The sanctuary expansion will add a further 2,500 ha of land within the predator-proof fenced area, bringing the total sanctuary area to approximately 5,200 ha (52km^2) with an estimated carrying capacity of up to 250 hirola.
Removal of bachelor herds of hirola from the sanctuary will also be considered in order to increase the female to male sex ratio, and potentially increase breeding rates. This can be done using a helicopter and driving bachelor herds through a gap created in the fence; however, it is logistically challenging and will require careful preparation. Insecurity poses an additional challenge to this type of management intervention.

Male hirola (© *Steve Garvey*)

Antelope News

Dama gazelle: success and setback

The Dama Gazelle Conservation Strategy workshop at Al Ain Zoo in December 2018, reviewed all options for saving the remaining animals, including ways to preserve the unique genetic diversity of the wild populations. Analyses of DNA have shown that the population in the Manga area of Chad possesses extremely high genetic diversity that is not represented in captivity. This population is very small and is not protected. After a thorough discussion on the benefits and risks, a key strategic recommendation of the workshop was to capture some of the surviving animals in Manga for captive breeding to preserve their unique genetic diversity.

The Sahara Conservation Fund (SCF) led a rescue operation in late January 2020 and assembled a multi-national team of experts from Chad's Directorate for Wildlife Conservation and Protected Areas, the Environment Agency Abu Dhabi, the Zoological Society of London, Fossil Rim Wildlife Center, the Smithsonian Conservation Biology Institute, Gulf Breeze Zoo, and Noé Conservation. The operation was largely financed by Fondation Segré and was

supported by a wide range of organizations including ASG, the Royal Zoological Society of Scotland, and Rewild.

The mission utilized a fixed-wing aircraft for survey, a helicopter for capture, and a ground support team. It lasted 12 days. After several days of searching, the ground team finally pinpointed some dama gazelles which the helicopter team located and successfully darted three females. The gazelles were transported by air to the Oryx release facility at Ouadi-Rimé-Ouadi Achim Game Reserve, 350 km away in central Chad. A rapid decision was made to catch a male from OROA to establish an initial breeding group.

In early April, one of the females was found dead in the enclosure. More watering sites and locations of feed pellets, salt licks, and browse were provided, but in mid-April a second female died. However, the remaining female and the male are doing well, and the female may be pregnant.

This is extremely sad news after the immense effort and the funding invested in the rescue operation, but it was known from the start that the risks were high, especially given the dama gazelle's delicate nature, but these risks were carefully considered, and balanced against the urgent need to preserve some of the invaluable genetic material, and the precarious situation of the tiny population in Manga, before the recommendation to capture was made.

Pronghorn migration threatened

The Path of the Pronghorn is an age-old migration route that connects pronghorn summer and winter ranges in Wyoming. Several hundred pronghorn spend summer in Grand Teton NP and Jackson Hole, where they give birth, usually to twins. To avoid the heavy winter snow, they begin to move south in early fall along a traditional 160-km route to their winter range in the Upper Green River Valley. The Path of the Pronghorn is one of the longest large mammal migration corridors remaining in North America. The migrating animals belong to the Sublette herd, which has already declined by 40% in the past decade. The northern portion of the route is protected as the U.S.'s first national pronghorn migration corridor. Oil and gas development is not allowed, wildlife overpasses and underpasses have been installed along major roadways, and millions of dollars have been spent on replacing barbed wire fences that prevent pronghorn passage with wildlife-friendly fencing. However, the southern portion of the corridor remains unprotected, and it has already been narrowed by two gas fields. This part of the corridor is now under threat from a plan to permit development of 3,500 new gas fracking wells. If the development is finally allowed it would block the corridor and threaten the future of this population of one of North America's most iconic species.

Sources:

https://www.theguardian.com/environment/2020/feb/24/pronghorn-migration-gas-wells *24 February 2020*

https://northamerica.wcs.org/wild-places/yellowstone-and-northern-rockies/pronghorn-field-program/pronghorn-migration-path.aspx

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Pronghorn antelope (© *Patrick Hendry*)

Pronghorn disease outbreak in Wyoming

On 16 March 2020 it was reported that more than 50 pronghorns had died near Gillette, Wyoming, from the same bacteria that killed more than 75 animals in 2019. The deaths north of Gillette were noted on 15 Feb 2020 and are blamed preliminarily on *Mycoplasma bovis*. The outbreak is being investigated by the Wyoming Game and Fish Department and the Wyoming State Veterinary Laboratory to study the outbreak in more detail. The source of infection, the ability to predict the duration, and the geographic distribution of this outbreak in pronghorn are unknown at this point. Game and Fish continues to monitor for the disease across the state. Except for the Gillette area, this bacterium has not been associated with significant mortality in other wildlife populations in Wyoming. *Mycoplasma bovis* should not be confused with *Mycobacterium bovis*, which causes tuberculosis in cattle.

*Source:*http://www.codyenterprise.com/news/local/article_91ae2af2-67b8-11ea-baad-6f80acb05654.html

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Colorado's booming pronghorn population

The Colorado pronghorn population numbered only around 5,000 in the 1940s but now totals more than 85,000, with an increase by 20,000 since 2004, and represents a game management success story. Pronghorn are thriving, and the state manages their numbers through hunting - Colorado issued 26,500 licenses to hunt pronghorn in 2018. More than 11,000 pronghorn were harvested in 2017, the latest year for which figures are available.

Expanding cities, roads, and subdivision of rangeland all put pressure on the pronghorn and reduce the area of habitat. Pronghorn can jump but prefer instead to crawl under fences.

Wildlife managers have repeatedly requested homeowners and developers to raise fences: either remove or raise the bottom strand so the animals have an easier time crawling under and avoid use of barbed wire. Wildlife managers mark fences with brightly colored tape to show pronghorn where they can easily crawl under, and the animals remember the spot. Some are hit by cars, especially along a stretch of U.S. 24, but pronghorn have become quite habituated to traffic.

Source: https://coloradosun.com/2019/01/21/colorado-pronghorn-antelope-recovery/

Poachers arrested in Somaliland

On 26 November 2019, nine UAE citizens were arrested by immigration police at Hargeisa airport and charged with illegal hunting. After spending four days in custody and paying 10,000 USD in fines they were deported to the UAE. Photos on regional websites show some of the detained persons with dead gazelles, including at least one Speke's gazelle *Gazella spekei*. The ministry of environment from Somaliland accused them of illegal poaching in Sabo Wanaag district. Speke's gazelle is categorized as Endangered on the IUCN Red List and is endemic to northern and eastern Somalia, including in Somaliland which has declared itself independent. Speke's gazelle occurs across Somaliland where it frequents the extensive open plains (known as *ban*) as well as small plains and open *Acacia-Commiphora* woodland. The species is protected by law but over the last 5-6 years visits by hunting groups from the Arabian Gulf have become more frequent, with access facilitated by certain VIPs. These groups of poachers tend to pursue animals indiscriminately, killing whatever they can find. Gazelles on the small plains within easy reach of close to the capital, Hargeisa, are especially vulnerable, and these small populations can easily be locally extirpated. The decisive and well-publicized action by the authorities in this case is therefore very welcome and will hopefully deter others.

Sources:

https://somalilandstandard.com/somaliland-govt-deports-uae-nationals-accused-of-illegal-poaching/

https://www.garoweonline.com/en/news/somaliland/somalia-nine-emirates-arrested-for-illegal-hunting-deported-to-uae

Speke's gazelles slaughtered in an earlier poaching incident in Somaliland (© *Anonymous*)

South Africa border fence

On 19 March 2020, South Africa announced the immediate construction of a 40-kiliometre fence along its border with Zimbabwe to prevent illegal immigrants from entering and spreading covid-19 virus. Details of the fence design are unavailable, but the fence is highly likely to present a barrier to movement of antelopes and all large mammals. Construction of border fences for security reasons is increasing in many parts of the world and adds another layer of barrier.

*Source:*https://www.reuters.com/article/health-coronavirus-safrica-zimbabwe-idUSL8N2BC6PD

Arabian oryx and gazelles released in Oman

On 15 March 2020 the Office for Conservation of the Environment at the Diwan of Royal Court released three antelope species into the Al Wusta Wildlife Reserve.

The release process of Arabian oryx, Arabian gazelle and Arabian sand gazelle (reem) was launched under the patronage of Hussain Ali Abdullatif, Advisor and Acting Secretary General of the Diwan of Royal Court, in the presence of the Governor of Al Wusta, besides members of the State Council and Majlis A'Shura. The project aims to support the Omani wildlife and expand the scope of scientific environmental research, to enable the animals to adapt to their natural habitats and release Arabian antelopes in the wildlife reserve. The reem is a pale-coated gazelle with long slender horns and well adapted to desert life. It is considered a vulnerable species because less than 2,500 remain in the wild.

Arabian oryx (© *muscatdaily.com*)

The Arabian oryx is a medium-sized antelope with a distinct shoulder bump, long, straight horns and a tufted tail. It is a bovid and the smallest member of the genus oryx, native to desert and steppe areas of the Arabian Peninsula. The project is being implemented in two phases with a total of 129 animals being released in the wild this year. The animals are being tagged to obtain movement data. The Office for Conservation of the Environment said that the satellite-based tags will help track animals' movement. "Blood samples of these animals will help in studies and scientific research and identifying the risks" the office said.
Source: https://muscatdaily.com/Archive/Oman/Oryxes-gazelles-released-in-wild-to-boost-population

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Impact assessment of COVID-19 on the South African wildlife ranching industry
https://drive.google.com/file/d/1zC-v-jOXSOw1ELADp5XIqZlp9XJYfAay/view

Recent published articles

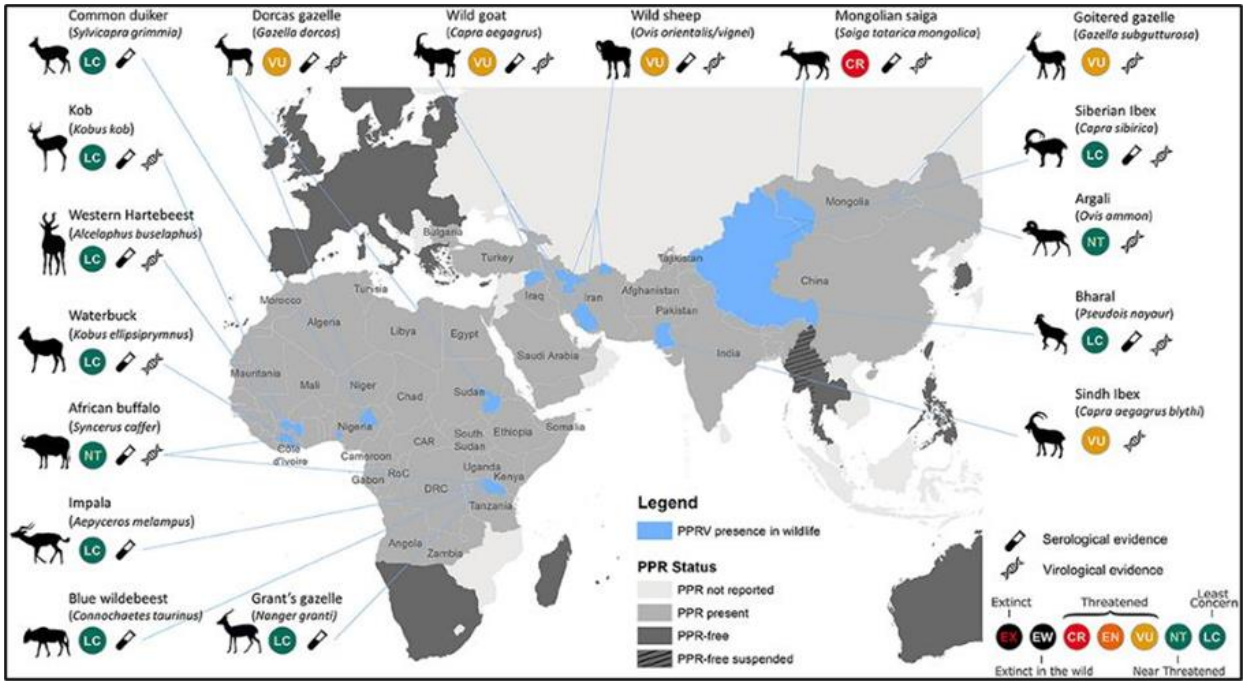
Outbreak of peste des petits ruminants virus among critically endangered Mongolian saiga and other wild ungulates, Mongolia, 2016–2017. Mathieu Pruvot, Amanda E. Fine, Charlotte Hollinger, Samantha Strindberg, Batchuluun Damdinjav, Bayarbaatar Buuveibaatar, Buyanaa Chimeddorj, Gantulga Bayandonoi, Bodisaikhan Khishgee, Batkhuyag Sandag, Jamiyankhuu Narmandakh, Tserenjav Jargalsaikhan, Batzorig Bataa, Denise McAloose, Munkhduuren Shatar, Ganzorig Basan, Mana Mahapatra, Muni Selvaraj, Satya Parida, Felix Njeumi, Richard Kock, Enkhtuvshin Shiilegdamba. 2020. *Emerging Infectious Diseases* 26: 1. DOI: https://doi.org/10.3201/eid2601.18199

Abstract
The 2016–2017 introduction of peste des petits ruminants virus (PPRV) into livestock in Mongolia was followed by mass mortality of the critically endangered Mongolian saiga antelope and other rare wild ungulates. To assess the nature and population effects of this outbreak among wild ungulates, we collected clinical, histopathologic, epidemiologic, and ecological evidence. Molecular characterization confirmed that the causative agent was PPRV lineage IV. The spatiotemporal patterns of cases among wildlife were similar to those among livestock affected by the PPRV outbreak, suggesting spillover of virus from livestock at multiple locations and time points and subsequent spread among wild ungulates. Estimates of saiga abundance suggested a population decline of 80%, raising substantial concerns for the species' survival. Consideration of the entire ungulate community (wild and domestic) is essential for elucidating the epidemiology of PPRV in Mongolia, addressing the threats to wild ungulate conservation, and achieving global PPRV eradication.

Eradication of Peste des Petits Ruminants Virus and the Wildlife-Livestock Interface. Amanda E. Fine, Mathieu Pruvot, Camilla T. O. Benfield, Alexandre Caron, Giovanni Cattoli, Philippe Chardonnet, Maurizio Dioli, Thomas Dulu, Martin Gilbert, Richard Kock, Juan Lubroth, Jeffrey C. Mariner, Stephane Ostrowski, Satya Parida, Sasan Fereidouni, Enkhtuvshin Shiilegdamba, Jonathan M. Sleeman, Claudia Schulz, Jean-Jacques Soula, Yves Van der Stede, Berhe G. Tekola, Chris Walzer, Steffen Zuther, Felix Njeumi and Meeting Participants. 2020. *Frontiers in Veterinary Science* 7:50. doi: 10.3389/fvets.2020.00050 https://www.frontiersin.org/articles/10.3389/fvets.2020.00050/full

Abstract

Growing evidence suggests that multiple wildlife species can be infected with peste des petits ruminants virus (PPRV), with important consequences for the potential maintenance of PPRV in communities of susceptible hosts, and the threat that PPRV may pose to the conservation of wildlife populations and resilience of ecosystems. Significant knowledge gaps in the epidemiology of PPRV across the ruminant community (wildlife and domestic), and the understanding of infection in wildlife and other atypical host species groups (e.g., camelidae, suidae, and bovinae) hinder our ability to apply necessary integrated disease control and management interventions at the wildlife-livestock interface. Similarly, knowledge gaps limit the inclusion of wildlife in the FAO/OIE Global Strategy for the Control and Eradication of PPR, and the framework of activities in the PPR Global Eradication Programme that lays the foundation for eradicating PPR through national and regional efforts. This article reports on the first international meeting on, "Controlling PPR at the livestock-wildlife interface," held in Rome, Italy, March 27–29, 2019. A large group representing national and international institutions discussed recent advances in our understanding of PPRV in wildlife, identified knowledge gaps and research priorities, and formulated recommendations. The need for a better understanding of PPRV epidemiology at the wildlife-livestock interface to support the integration of wildlife into PPR eradication efforts was highlighted by meeting participants along with the reminder that PPR eradication and wildlife conservation need not be viewed as competing priorities, but instead constitute two requisites of healthy socio-ecological systems.



Mass die-off of saiga antelopes, Kazakhstan, 2015. Sasan Fereidouni, Graham L. Freimanis, Mukhit Orynbayev, Paolo Ribeca, John Flannery, Donald P. King, Steffen Zuther, Martin Beer, Dirk Höper, Aidyn Kydyrmanov, Kobey Karamendin, Richard Kock. 2019. *Emerging Infectious Diseases* 25(6) June 2019.

Abstract

In 2015, a mass die-off of ≈200,000 saiga antelope in central Kazakhstan was caused by hemorrhagic septicemia attributable to the bacterium *Pasteurella multocida* serotype B. Previous analyses have indicated that environmental triggers associated with weather conditions, specifically air moisture and temperature in the region of the saiga antelope calving during the 10-day period running up to the event, were critical to the proliferation of latent bacteria and were comparable to conditions accompanying historically similar die-offs in the same areas. We investigated whether additional viral or bacterial pathogens could be detected in samples from affected animals using 3 different high-throughput sequencing approaches. We did not identify pathogens associated with commensal bacterial opportunisms in blood, kidney, or lung samples and thus concluded that *P. multocida* serotype B was the primary cause of the disease.

Saiga antelope (© *Wikimedia Commons*)

Opportunistic bacteria and mass mortality in ungulates: lessons from an extreme event. Sarah Robinson, E. J. Milner-Gulland, Yuri Grachev, Albert Salemgurayev, Mukhit Orynbayev, Anna Luschekina, Eric Morgan, Wendy Beauvais, Navinder Singh, Sergei Khomenko, Rosie Cammack, Richard Kock. 2019. *Ecosphere* www.esajournals.org June 2019 Volume 10(6) Article e02671

Abstract
Mass mortality events in wildlife are a growing concern. Under conditions of rapid global change, opportunistic responses in bacterial commensals, triggered by environmental stressors, may be increasingly implicated in die-offs. In 2015, over 200,000 saiga antelope died of hemorrhagic septicemia caused by the pathogen *Pasteurella multocida* serotype B. We use this case to explore die-offs from commensal bacteria more broadly, looking at factors which might favor such extreme events. We review other recorded disease outbreaks caused by *Pasteurellaceae* organisms, firstly in saiga and secondly in other wild ungulates, and ask whether the 2015 die-off was unprecedented in terms of mortality rates, numbers dead, spatial scale, and in the nature of the predisposing or environmental factors involved. We also compare these outbreaks with mass mortality events associated with commensal bacteria in wildlife more generally. We identify three additional major die-offs in saiga in which *Pasteurellaceae* organisms may be implicated, of which one in 1988 closely resembles the 2015 hemorrhagic septicemia event. No other recorded cases in wild ungulates approach the magnitude of these cases for any of the metrics considered, possible exceptions being die-offs in Mongolian gazelles, in which the role of these pathogens is poorly substantiated. Environmental triggers were the most commonly suggested factor leading to pathogenesis, with warm humid conditions most commonly associated with hemorrhagic septicemia. Life history may also be significant, saigas are migratory and the largest pasteurellosis outbreaks outside this species also occur in migratory species of bird or other temperate ungulates aggregating in large numbers. Cases provoked by other commensals tend to be small in magnitude. Exceptions involve interactions between multiple pathogens and climatic conditions or sets of climatic conditions acting on different stages of the host–pathogen life cycle, leading to time lags between infection and subsequent disease. Overall, the scale and rapidity of the saiga die-offs appear unprecedented among mortality events caused by bacterial commensals in wild mammals. Experimental research into the genetics and microbiology of host–pathogen interactions upon changes in the external environment, and monitoring of animals and conditions at calving sites, may eventually reveal the underlying causes of these die-offs.

Biological characterization of *Pasteurella multocida* present in the Saiga population. Mukhit Orynbayev , Kulyaisan Sultankulova, Abylay Sansyzbay, Rashida Rystayeva, Kamshat Shorayeva,Aidar Namet, Sasan Fereidouni, Gulnaz Ilgekbayeva, Kainar Barakbayev, Syrym Kopeyev and Richard Kock. 2019. *BMC Microbiology* 19:37 https://doi.org/10.1186/s12866-019-1407-9

Abstract
Background. This study provides biochemical and molecular genetic characteristics of *P. multocida* isolated from dead saigas in 1988, 2010–2015 on the territory of the Republic of Kazakhstan.
Results. Bacteriological samples taken from carcasses of saiga antelope during mortality events recorded in West Kazakhstan in both 2010 and 2011 and in Kostanay in 2012 and 2015 confirmed the presence of *P. multocida*, according to morphological and biochemical

characterization. Only in the event of 2015 was the agent proven to be the causative agent of the disease observed, haemorrhagic septicaemia. In the other mortality events, it is not certain if the organism was a primary aetiology or an incidental finding as confirmatory pathological investigation was not undertaken. The implemented phylogenetic analysis of ribosomal RNA 16S gene allowed us to identify Pasteurella strains isolated in 2010–2015 as *P. multocida* subspecies *multocida*. Capsular typing by PCR showed that the studied strains isolated from dead saiga in 2010, 2011, 2012 and 2015 belonged to serotype B. MLST analysis showed that these strains of *P. multocida* are of the capsule type B and form one clonal grouping with isolates ST64, ST44, ST45, ST46, ST44, ST47 which isolated from cases of hemorrhagic septicemia of animals in Hungary, Burma, Sri Lanka, Pakistan and Spain. Sixteen virulence genes of the five strains of *P. multocida*, isolated from saigas were studied using multiplex PCR. ptfA, ompA, ompH, oma87, plpB, fimA, hsf-2, pfhA, exbB, tonB, hgbA, fur, nanB, nanH and pmHAS genes were detected in all strains. The toxA gene was not identified in the studied strains. The phylogenies of these isolates is compared across saiga populations and years and the 2015 isolate was compared to that of an isolate from a disease outbreak in 1988 and the findings suggest that these isolated bacteria are stable commensals, opportunistically pathogenic, being phylogenetically uniform with very little genetic variation notable over the last 4 decades.

Conclusion. Isolation, phenotypic and genetic characterization of the *P. multocida* isolates inform understanding of the epidemiology of infection in saigas and predict virulent potential of these opportunistic bacteria.

Temporal patterns in natality and mortality of three threatened antelope species in North Africa: *Oryx dammah, Addax nasomaculatus* and *Nanger dama.* Mohamed Wassim Hizem, Philip Riordan, Haithem El-Farhati, Lazhar Hamdi and Saïd Nouira. 2019. *African Journal of Ecology* 57(4): 575-585. https://doi.org/10.1111/aje.12606

Abstract

Long-term population studies on large mammals are rare. Here, we have examined the threatened scimitar-horned oryx, addax and dama gazelle's populations over the last 20 years in Bou Hedma National Park. Using monthly count data of the three studied species collected since 1995, we examined their population trends. Using autocorrelation analyses, we discovered endogenous natural cyclical fluctuations in the numbers of each species, with a periodicity of approximately 3 years. For all three studied species which seem to be opportunistic breeders, births and deaths occurred throughout the year, although with notable seasonality. By means of cross-correlation, we discovered that during the first 7 years for which data were available, addax numbers were positively correlated with those of dama and inversely correlated with numbers of oryx. This pattern reversed during the following 4-year period. The number of oryx was negatively correlated with dama during the first 4 years and then became positively correlated during the subsequent 7-year period. Thus, we draw attention to difference in response to environmental and anthropogenic factors. Incorporating fundamental long-term population data into developing management approaches, especially for potentially competitive species, is vital for their future long-term survival and the success of conservation actions.

Factors driving Arabian gazelles (*Gazella arabica*) in Israel to extinction: time series analysis of population size and juvenile survival in an unexploited population. Benny Shalmon, Ping Sun, Torsten Wronski. 2019. *Biodiversity and Conservation* https://doi.org/10.1007/s10531-019-01884-8

Abstract
Wild populations of Arabian gazelles (*Gazella arabica*) were once common on the Arabian Peninsula, but today disappeared from large parts of their former range. In Israel only a small population of currently 30 individuals survived, although it was - and still is – well protected from illegal hunting and habitat destruction. In our study we aimed to identify the factors influencing the population growth of *G. arabica* in Israel over the last two decades (1995–2017). We tested the impact of five environmental variables including annual mean maximum temperature, rainfall, the availability of two major food plants, competition with sympatric dorcas gazelle (*G. dorcas*) and predation (mainly by wolves) on two dependent variables relating to population viability (population size, percentage fawn survival) using a retrospective time series analysis. After testing for autocorrelations, two generalized least squares (GLS) models with autocorrelations at 3 and 6 years [GLS-AR(3, 6)] were identified as the best models to explain environmental effects on populations size. Wolf encounter rate had a significant negative effect on *G. arabica* population size, while *G. Dorcas* population size had a significant positive effect, suggesting that wolf predation shapes the population size of both gazelle species. For percentage fawn survival, model residuals did not reveal any significant autocorrelation and the best ft GLS-AR(0) model retained only wolf encounter rate and mean annual maximal temperature as significant predictors. This result suggests a strong impact of wolf predation and increasing temperatures on the fawn survival of Arabian gazelles. Changed rainfall patterns, food availability and competition between gazelle species had no impact on fawn survival.

Management background and release conditions structure post-release movements in reintroduced ungulates. Katherine Mertes, Jared A. Stabach, Melissa Songer, Tim Wacher, John Newby, Justin Chuven, Shaikha Al Dhaheri, Peter Leimgruber and Steven Monfort. 2019. *Frontiers in Ecology and Evolution* 7: 470. http://doi:10.3389/fevo.2019.00470

Abstract
One of the greatest challenges in restoring species to the wild is insufficient knowledge about their habitat requirements and movement ecology. This is especially true for wide-ranging species such as the scimitar-horned oryx (*Oryx dammah*). Once widespread across Sahelo-Saharan grasslands, oryx were declared Extinct in the Wild in 1999.
Here, we integrate GPS/satellite tracking, remote sensing, and movement analyses to assess how reintroduced oryx respond to wild conditions. We monitored two groups of oryx, reared under different captive management regimes and released in different seasons, for 12 months after release. Our study provides the first movement trajectories and home range estimates for this species. We expected oryx movements after release to represent trade-offs between risky, energetically expensive exploration and resource exploitation. Oryx raised under semi-free ranging conditions and released during the wet season ("ranging") exhibited this pattern of exploration followed by home range establishment. In contrast, oryx raised in small pens and released during the dry season ("penned") explored far less novel terrain. Ranging oryx exhibited seasonal shifts in activity and movement timing, while penned oryx simply reduced overall movement and continuously accessed supplemental food and water. Sahelian

ecosystems exhibit strong seasonal cycles and extensive spatial variation. In this highly variable environment, reintroduced oryx will need to disperse from the release site to acquire adequate forage throughout the year. Thus, we experimentally varied acclimation period, and expected dispersal to decrease with acclimation period length. Post-release dispersal ranged from 2 to 90 km: ranging oryx acclimated for ca. 6 months moved 40–60 km from the release site, while penned oryx acclimated for ca. 1 month remained within 5–25 km.
Our results demonstrate that captive management and environmental conditions at release strongly influence the extent to which reintroduced oryx disperse and adapt to wild conditions. We also show that - in contrast to previous studies - longer acclimation periods do not necessarily lead to site fidelity. Finally, our findings demonstrate the importance of tracking a large proportion of reintroduced individuals to (1) accurately record post-release behaviors and vital rates, and (2) adaptively evaluate pre- and post-release management actions to improve conservation outcomes.

Assessing introgressive hybridization in roan antelope (*Hippotragus equinus*): Lessons from South Africa. Anna M. van Wyk, Desiré L. Dalton, Antoinette Kotzé, J. Paul Grobler, Prudent S. Mokgokong, Anna S. Kropff, Bettine Jansen van Vuuren. 2019. *PLoS ONE* 14(10): e0213961. https://doi.org/10.1371/journal.pone.0213961

Abstract
Biological diversity is being lost at unprecedented rates, with genetic admixture and introgression presenting major threats to biodiversity. Our ability to accurately identify introgression is critical to manage species, obtain insights into evolutionary processes, and ultimately contribute to the Aichi Targets developed under the Convention on Biological Diversity.
The current study concerns roan antelope, the second largest antelope in Africa. Despite their large size, these antelope are sensitive to habitat disturbance and interspecific competition, leading to the species being listed as Least Concern but with decreasing population trends, and as extinct over parts of its range. Molecular research identified the presence of two evolutionary significant units across their sub-Saharan range, corresponding to a West African lineage and a second larger group which includes animals from East, Central and Southern Africa. Within South Africa, one of the remaining bastions with increasing population sizes, there are a number of West African roan antelope populations on private farms, and concerns are that these animals hybridize with roan that naturally occur in the southern African region.
We used a suite of 27 microsatellite markers to conduct admixture analysis. Our results indicate evidence of hybridization, with our developed tests using a simulated dataset being able to accurately identify F1, F2 and non-admixed individuals at threshold values of qi > 0.80 and qi > 0.85. However, further backcrosses were not always detectable with backcrossed-Western roan individuals (46.7–60%), backcrossed-East, Central and Southern African roan individuals (28.3–45%) and double backcrossed (83.3–98.3%) being incorrectly classified as non-admixed.
Our study is the first to confirm ongoing hybridization in this within this iconic African antelope, and we provide recommendations for the future conservation and management of this species.

Whole genome sequencing and re-sequencing of the sable antelope (*Hippotragus niger*): A resource for monitoring diversity in *ex situ* and *in situ* populations. Klaus-Peter Koepfli, Gaik Tamazian, David Wildt, Pavel Dobrynin, Changhoon Kim, Paul B. Frandsen, Raquel Godinho, Andrey A. Yurchenko, Aleksey Komissarov, Ksenia Krasheninnikova, Sergei Kliver, Sofia Kolchanova, Margarida Gonçalves, Miguel Carneiro, Pedro Vaz Pinto, Nuno Ferrand, Jesús E. Maldonado, Gina M. Ferrie, Leona Chemnick, Oliver A. Ryder, Warren E. Johnson, Pierre Comizzoli, Stephen J. O'Brien and Budhan S. Pukazhenthi. 2019. *G3: Genes, Genomes, Genetics* 9(6): 1785-1793. https://doi.org/10.1534/g3.119.400084

Abstract
Genome-wide assessment of genetic diversity has the potential to increase the ability to understand admixture, inbreeding, kinship and erosion of genetic diversity affecting both captive (*ex situ*) and wild (*in situ*) populations of threatened species. The sable antelope (*Hippotragus niger*), native to the savannah woodlands of sub-Saharan Africa, is a species that is being managed *ex situ* in both public (zoo) and private (ranch) collections in the United States. Our objective was to develop whole genome sequence resources that will serve as a foundation for characterizing the genetic status of *ex situ* populations of sable antelope relative to populations in the wild. Here we report the draft genome assembly of a male sable antelope, a member of the subfamily *Hippotraginae* (*Bovidae, Cetartiodactyla, Mammalia*). The 2.596 Gb draft genome consists of 136,528 contigs with an N50 of 45.5 Kbp and 16,927 scaffolds with an N50 of 4.59 Mbp. *De novo* annotation identified 18,828 protein-coding genes and repetitive sequences encompassing 46.97% of the genome. The discovery of single nucleotide variants (SNVs) was assisted by the re-sequencing of seven additional captive and wild individuals, representing two different subspecies, leading to the identification of 1,987,710 bi-allelic SNVs. Assembly of the mitochondrial genomes revealed that each individual was defined by a unique haplotype and these data were used to infer the mitochondrial gene tree relative to other hippotragine species. The sable antelope genome constitutes a valuable resource for assessing genome-wide diversity and evolutionary potential, thereby facilitating long-term conservation of this charismatic species.

Benefits and pitfalls of captive conservation genetic management: Evaluating diversity in scimitar-horned oryx to support reintroduction planning. Rob Ogden, Justin Chuven, Tania Gilbert, Caroline Hosking, Karim Gharbi, Mark Craig, Shaikha Salem Al Dhaheri, Helen Senn. 2020. *Biological Conservation* 241: 108244. https://doi.org/10.1016/j.biocon.2019.108244

Abstract
The reintroduction of the scimitar-horned oryx to Chad is a multi-disciplinary endeavour, planned and implemented over the past decade, utilizing a wide range of conservation science applications to maximise the chances of long-term population sustainability. The principle of incorporating genetic diversity information into founder selection for species reintroductions is widely recognized; however, in practice, a full assessment of available *ex-situ* genetic variation is rarely attempted prior to identifying individuals for release. In this study we present the results of over ten years of research analyzing and interpreting the genetic diversity present in the key source populations for the Chad scimitar-horned oryx reintroduction. Three empirical genetic datasets (mitochondrial DNA sequence, nuclear DNA microsatellite and SNP markers) comprising over 500 individuals sampled from public and private institutions were analysed, accompanied by simulation studies to address applied questions relating to

management of the reintroduction. The results strongly demonstrate the importance of conservation genetic analysis in ensuring that founders represent the greatest breadth of evolutionary diversity available. The inclusion of both intensively and lightly managed collections allowed us to bridge the gap between studbook and group managed populations, enabling the inclusion of individuals from populations that lack historic data on their origins, but which may hold unique diversity of significant conservation value. Importantly, however, our study also reveals the potential risks of applying standard population genetic approaches to multiple captive populations, for which small founder sizes are likely to strongly bias results, with potentially serious consequences for the genetic management of conservation breeding programmes.

Rapid ecological specialization despite constant population sizes. Andrinajoro R. Rakotoarivelo, Paul O'Donoghue, Michael W. Bruford and Yoshan Moodley. 2019. *PeerJ* **7**:e6476 http://doi.org/10.7717/peerj.6476

Abstract

Background. The bushbuck, *Tragelaphus scriptus*, is a widespread and ecologically diverse ungulate species complex within the spiral-horned antelopes. This species was recently found to consist of two genetically divergent but monophyletic lineages, which are paraphyletic at mitochondrial (mt)DNA owing to an ancient interspecific hybridization event. The Scriptus lineage (*T. s. scriptus*) inhabits the north-western half of the African continent while Sylvaticus (*T. s. sylvaticus*) is found in the south-eastern half. Here we test hypotheses of historical demography and adaptation in bushbuck using a higher-resolution framework, with four nuclear (MGF, PRKCI, SPTBN, and THY) and three new mitochondrial markers (cytochrome b, 12S rRNA, and 16S rRNA).

Methods. Genealogies were reconstructed for the mitochondrial and nuclear data sets, with the latter dated using fossil calibration points. We also inferred the demographic history of Scriptus and Sylvaticus using coalescent-based methods. To obtain an overview of the origins and ancestral colonisation routes of ancestral bushbuck sequences across geographic space, we conducted discrete Bayesian phylogeographic and statistical dispersal-vicariance analyses on our nuclear DNA data set.

Results. Both nuclear DNA and mtDNA support previous findings of two genetically divergent Sylvaticus and Scriptus lineages. The three mtDNA loci confirmed 15 of the previously defined haplogroups, including those with convergent phenotypes. However, the nuclear tree showed less phylogenetic resolution at the more derived parts of the genealogy, possibly due to incomplete lineage sorting of the slower evolving nuclear genome. The only exception to this was the montane Menelik's bushbuck (Sylvaticus) of the Ethiopian highlands, which formed a monophyletic group at three of four nuclear DNA loci. We dated the coalescence of the two lineages to a common ancestor ~2.54 million years ago. Both marker sets revealed similar demographic histories of constant population size over time. We show that the bushbuck likely originated in East Africa, with Scriptus dispersing to colonise suitable habitats west of the African Rift and Sylvaticus radiating from east of the Rift into southern Africa via a series of mainly vicariance events.

Discussion. Despite lower levels of genetic structure at nuclear loci, we confirmed the independent evolution of the Menelik's bushbuck relative to the phenotypically similar montane bushbuck in East Africa, adding further weight to previous suggestions of convergent evolution within the bushbuck complex. Perhaps the most surprising result of our analysis was that both *Scriptus* and *Sylvaticus* populations remained relatively constant throughout the

Pleistocene, which is remarkable given that this was a period of major climatic and tectonic change in Africa, and responsible for driving the evolution of much of the continent's extant large mammalian diversity.

Breeding centers, private ranches, and genomics for creating sustainable wildlife populations. David Wildt, Philip Miller, Klaus-Peter Koepfli, Budhan Pukazhenthi, Katy Palfrey, Gavin Livingston, Dan Beetem, Stephen Shurter, Jimmy Gregory, Michael Takács, and Kelley Snodgrass. 2019. *BioScience* 69: 928–943.

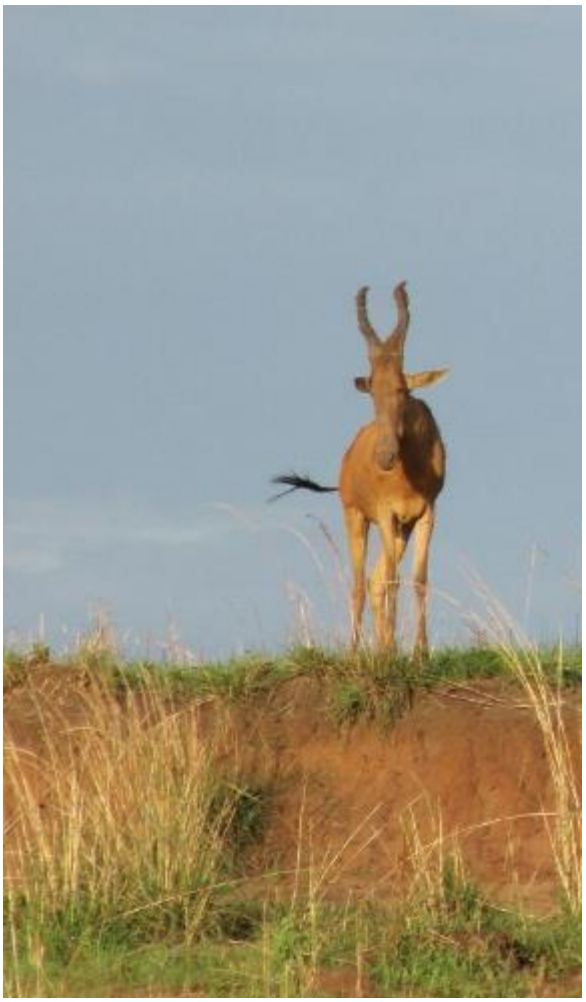
Abstract
Human-induced changes to environments are causing species declines. Beyond preserving habitat (*in situ*), insurance (*ex situ*) populations are essential to prevent species extinctions. The Conservation Centers for Species Survival (C2S2) is leveraging space of breeding centers and private ranches to produce "source populations", genetically diverse reservoirs that also support research and reintroductions. The initial focus is on four African antelopes. C2S2 has developed a program, the Source Population Alliance, that emphasizes animals living in spacious, naturalistic conditions in greater numbers than can be accommodated by urban zoos. Simulation modelling demonstrates how herds can rapidly increase population abundance and retain genetic diversity. Advances in genomics and resulting DNA data allow monitoring of genetic diversity and parentage as well as refined decision-making. This approach, neither pure *in situ* nor *ex situ*, but rather "*sorta situ*", is an innovative way of linking public and private sector resources to ensure that endangered species survive.

Eastern bongo (© *White Oak Conservation*)

Apparent competition, lion predation, and managed livestock grazing: Can conservation value be enhanced? Caroline C. Ng'weno, Steven W. Buskirk, Nicholas J. Georgiadis, Benard C. Gituku, Alfred K. Kibungei, Lauren M. Porensky, Daniel I. Rubenstein and Jacob R. Goheen. 2019. *Frontiers in Ecology and Evolution* 7: 123. http://doi:10.3389/fevo.2019.00123

Abstract

Predator restorations often result in apparent competition, where co-occurring prey populations experience asymmetric predation pressure driven by predator preferences. In many rangeland ecosystems, livestock share the landscape with wildlife, including ungulates and the large carnivores that consume them. We examined whether apparent competition reorganized prey communities following restoration of lions (*Panthera leo*) to a savanna ecosystem, and whether and how livestock management could alter this indirect interaction between lions and their prey. Three lines of evidence supported the hypothesis that Jackson's hartebeest (*Alcelaphus bucelaphus lelwel*; an ungulate of conservation concern) are suppressed via lion-mediated apparent competition. First, hartebeest exhibited an Allee effect where they were exposed to lions, but displayed negative density-dependent population growth where they were protected from lions. Second, spatial overlap between plains zebra (*Equus burchelli*; the primary prey of lions) and hartebeest further exacerbated lion predation on hartebeest. Finally, hartebeest were killed selectively by lions, whereas zebra were killed by lions in proportion to their abundance. We then tested whether glades [nutrient-rich hotspots created by abandoned cattle (*Bos indicus*) corrals] could be used to manipulate top-down control of hartebeest via their influence on the spatial distribution of zebra. Zebra aggregated at glades, and survival of hartebeest increased with increasing distance from glades, suggesting that corrals may be placed on the landscape away from hartebeest to create spatial refuges from lions. Our findings demonstrate how informed placement of livestock corrals can be used to manipulate the spatial distribution of primary prey (zebra), thereby reducing apparent competition suffered by hartebeest. Our work further provides an example of how integrating apparent competition theory with proactive livestock management can improve conservation efforts in multiple-use landscapes.



Jackson's Hartebeest (*@ Wikimedia Commons*)

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East (1990) said……
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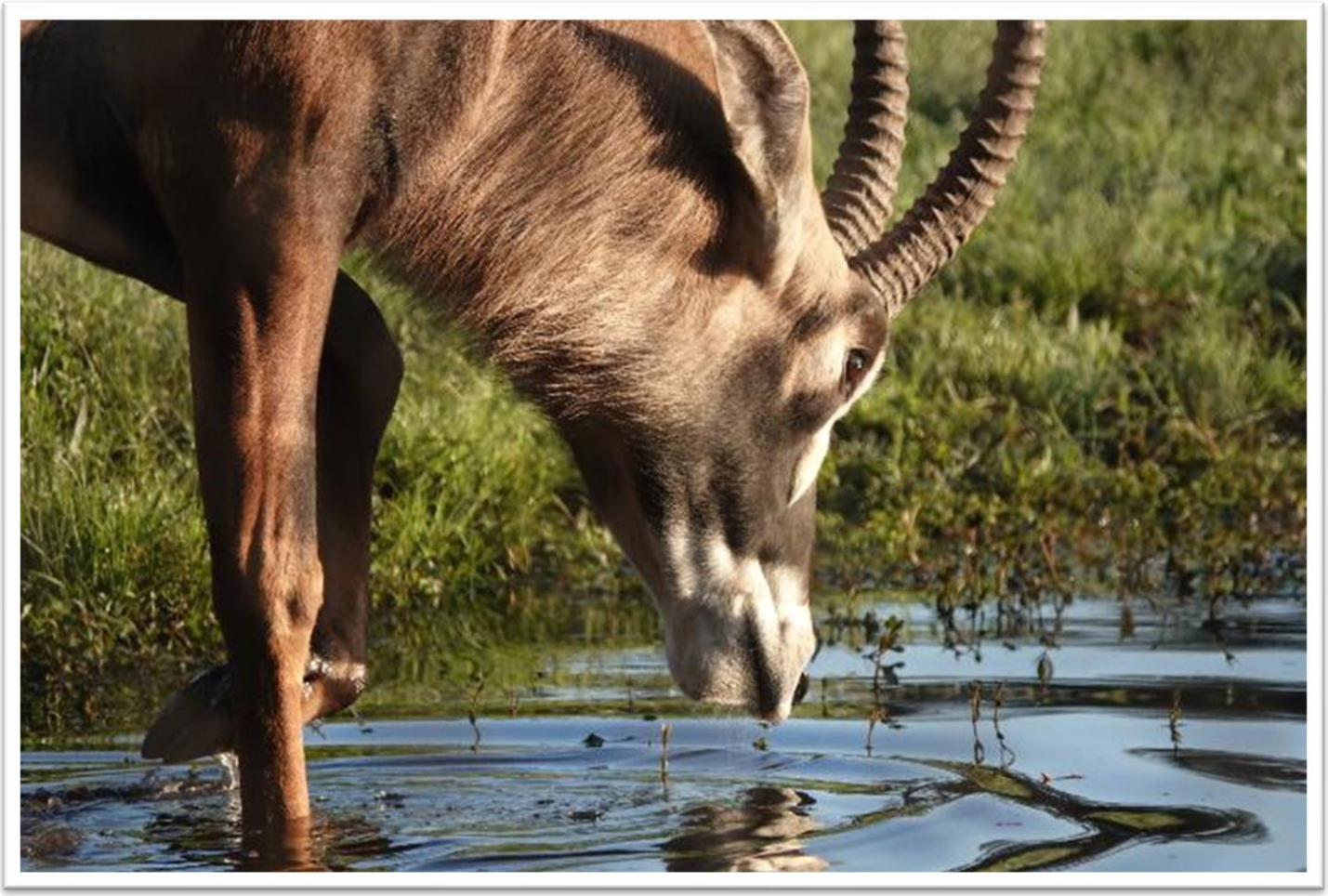
Stanley-Price, M.R. 1989. *Animal Reintroductions: the Arabian Oryx in Oman*. Cambridge University Press, Cambridge, UK.

Grimshaw, J.M., Cordeiro, N.J. and Foley, C.A.H. 1995. The mammals of Kilimanjaro. *Journal of the East Africa Natural History Society* 84: 105-139.

Hillman, J. C. 1979. The biology of the Eland (*Taurotragus oryx* Pallas) in the wild. PhD thesis, University of Nairobi, Kenya.

IUCN. 2016. The IUCN Red List of Threatened Species. Version 2016-3. Available at: www.iucnredlist.org. (Accessed: 07 December 2016).

Kingdon, J. 2013. Genus *Tragelaphus*. In: J.S. Kingdon and M. Hoffmann (eds). *The Mammals of Africa*, pp. 138-141. Academic Press, Amsterdam, The Netherlands.



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